

NUCLEIC ACID MOLECULES AND OTHER MOLECULES ASSOCIATED WITH
TRANSCRIPTION IN PLANTS

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority under 35 U.S.C. § 119(e) and/or 35 U.S.C. § 120 of applications No. 60/067,000 filed November 24, 1997; No. 60/069,472 filed December 9, 1997; No. 60/071,479 filed January 13, 1998; No. 60/074,201 filed February 10, 1998; No. 60/074,282 filed February 10, 1998; No. 60/074,280 filed February 10, 1998; No. 60/074,281 filed February 10, 1998; No. 60/074,566 filed February 12, 1998; No. 60/074,567 filed February 12, 1998; No. 60/074,565 filed February 12, 1998; No. 60/075,462 filed February 19, 1998; No. 60/074,789 filed February 19, 1998; No. 60/075,459 filed February 19, 1998; No. 60/075,461 filed February 19, 1998; No. 60/075,464 filed February 19, 1998; No. 60/075,460 filed February 19, 1998; No. 60/075,463 filed February 19, 1998; No. 60/077,231 filed March 9, 1998; No. 60/077,229 filed March 9, 1998; No. 60/077,230 filed March 9, 1998; No. 60/078,368 filed March 18, 1998; No. 60/080,844 filed April 7, 1998; No. 60/083,067 filed April 27, 1998, "Nucleic Acid Molecules and Other Molecules Associated with Plants.(soymon016)" docket No. 38-21(15348)A filed April 29, 1998; No. 60/083,387 filed April 29, 1998; No. 60/083,388 filed April 29, 1998; No. 60/083,389 filed April 29, 1998; No. 60/085,224 filed May 13, 1998; No. 60/085,223 filed May 13, 1998; No. 60/085,222 filed May 13, 1998; No. 60/085,533 filed May 15, 1998; No. 60/086,186 filed May 21, 1998; No. 60/086,187 filed May 21, 1998; No. 60/086,185 filed May 21, 1998; No. 60/086,184 filed May 21, 1998; No. 60/086,183 filed May 21, 1998; No. 60/086,188 filed May 21, 1998; No. 60/089,524 filed June 16, 1998; No. 60/089,810 filed June 18, 1998; No. 60/089,814 filed June 18, 1998; No. 60/089,808 filed June 18, 1998; No. 60/089,812 filed June 18, 1998; No. 60/089,807 filed June 18, 1998; No. 60/089,806 filed June

18, 1998; No. 60/089,813 filed June 18, 1998; No. 60/089,811 filed June 18, 1998; No. 60/089,793 filed June 18, 1998; No. 60/091,405 filed June 30, 1998, "Nucleic acid molecules and other molecules associated with the Plant Sugar and Nitrogen Transporters Pathway" docket No. 38-21(15412)A filed June 30, 1998; No. 60/099,667 filed September 9, 1998; No. 60/099,668 filed September 9, 1998; No. 60/099,670 filed September 9, 1998; No. 60/099,697 filed September 9, 1998; No. 60/100,674 filed September 16, 1998; No. 60/100,673 filed September 16, 1998; No. 60/100,672 filed September 16, 1998; No. 60/100,963 filed September 17, 1998; No. 60/101,131 filed September 21, 1998; No. 60/101,132 filed September 21, 1998; No. 60/101,130 filed September 21, 1998; No. 60/101,508 filed September 22, 1998; No. 60/101,344 filed September 22, 1998; No. 60/101,347 filed September 22, 1998; No. 60/101,343 filed September 22, 1998; No. 60/101,707 filed September 25, 1998; No. 60/104,126 filed October 13, 1998; No. 60/104,128 filed October 13, 1998; No. 60/104,127 filed October 13, 1998; No. 60/104,124 filed October 13, 1998; No. 60/109,018 filed November 18, 1998; No. 60/108,996 filed November 18, 1998, "Nucleic Acid Molecules and Other Molecules Associated With Plants" docket No. 38-21(15075)B filed November 24, 1998, "Nucleic Acid Molecules and Other Molecules Associated With Plants" docket No. 38-21(15076)B filed December 8, 1998, "Nucleic acid Molecules and other Molecules associated with Plants" docket No. 38-21(15668)A filed December 11, 1998 and "Nucleic acid molecules and other molecules associated with plants" docket No. 38-21(15721)A filed December 22, 1998, all of which are herein incorporated by reference in their entirety.

FIELD OF THE INVENTION

The present invention is in the field of plant biochemistry. More specifically the invention relates to nucleic acid sequences from plant cells, in particular, nucleic acid sequences

from maize and soybean plants and *Arabidopsis thaliana* associated with transcription in plants.

The invention encompasses nucleic acid molecules that encode proteins and fragments of proteins. In addition, the invention also encompasses proteins and fragments of proteins so encoded and antibodies capable of binding these proteins or fragments. The invention also relates to methods of using the nucleic acid molecules, proteins and fragments of proteins and antibodies, for example for genome mapping, gene identification and analysis, plant breeding, preparation of constructs for use in plant gene expression and transgenic plants.

BACKGROUND OF THE INVENTION

I. Transcription Factors

Eukaryotic transcription utilizes three different RNA polymerases. RNA polymerase I is located in the nucleolus and catalyzes the synthesis of ribosomal RNA. RNA polymerase II and III are present in the nucleoplasm. DNA dependent RNA synthesis by RNA polymerase III transcription complexes is responsible for the transcription of the genes that encode small nuclear RNAs and transfer RNA. RNA polymerase II transcribes the majority of the nuclear structural genes which typically encode proteins (type II genes).

In higher eukaryotes type II gene expression is often regulated, at least in part, at the level of transcription. A typical type II gene has one or more regulatory regions which include a promoter and one or more structural regions which is transcribed into precursor and messenger RNA. Type II genes are characterized by an upstream promoter region. Such regions are typically found between the start of transcription and 2000 bases distal to that transcriptional start site. Different combinations of sequence motifs can be associated with the upstream promoter region. These sequence motifs are recognized by sequence specific DNA binding proteins (transcription factors).

The polypeptide chains of transcription factors are usually divided into two functionally different regions, one that specifically binds to nucleic acid molecules and another that is associated with the activation of transcription. These functions are often present on different domains.

Several distinct structural elements or DNA binding domains which allow the transcription factor to bind to DNA in a sequence specific manner have been identified (Branden and Tooze, *Introduction to Protein Structure*, Garland Publishing, Inc., New York (1990), the entirety of which is herein incorporated by reference). These binding domains often range in size from approximately 20 residues to more than 80 residues. Many DNA binding domain exhibit one or another of the following structural motifs: the helix-turn-helix motif, the zinc finger motif, and the leucine zipper motif. Other structural motifs include: the helix-loop-helix motif, the *pou* motif and the multi-cysteine zinc finger.

Two sequence motifs or *cis* elements, the TATA box and the CAAT box are located within the promoter region of most type II genes. An AT-rich sequence called a TATA box is located approximately 30 nucleotides upstream from the start of transcription and is reported to play a role in positioning the start of transcription. A TATA box binding protein or TFIID factor has been identified that binds to this region (Hancock, *Nucleic Acid Research* 21: 2823-2830 (1993), the entirety of which is herein incorporated by reference; Gasch *et al.*, *Nature* 346: 390-394 (1990), the entirety of which is herein incorporated by reference)(the TFIID factor is also referred to as the TBP/TAF factors). It has been reported that binding of TFIID to the TATA box plays a role in the assembly of other transcription factors to form a complex capable of initiating transcription (Nakajima *et al.*, *Mole. Cell. Biol.* 8: 4038-4040 (1988), the entirety of which is herein incorporated by reference; Van Dyke *et al.*, *Science* 241: 1335-1338 (1988), the

entirety of which is herein incorporated by reference; Buratowski *et al.*, *Cell* 56: 549-561 (1989), the entirety of which is herein incorporated by reference).

In addition to the TATA box sequence, a CAAT box sequence is usually located approximately 75 bases upstream of the start of transcription. A CAAT box sequence binds a number of proteins, some of which are expressed in all tissues while others are expressed in a tissue specific manner (Branden and Tooze, *Introduction to Protein Structure*, Garland Publishing, Inc., New York (1990). One example of a CAAT box binding protein is the protein referred to as the CAAT box binding protein (C/EBP).

The G-box is a *cis*-acting element found within the promoters of many plant genes where it mediates expression in response to a variety of different stimuli (Schindler *et al.*, *EMBO J.* 11:1275-1289 (1992), the entirety of which is herein incorporated by reference). The G-box comprises a palindromic DNA motif (CACGTG) which is composed of two identical half sites (Donald *et al.*, *EMBO J.* 9:1727-1735 (1990); Izawa *et al.*, *J. Mol. Biol.* 230:1131-1144 (1993) Schindler *et al.*, *Plant Cell* 4:1309-1319 (1992); Schindler *et al.*, *EMBO J.* 11:1275-1289 (1992); Odea *et al.*, *EMBO J.* 10:1793-1991 (1991) Weisshaar *et al.*, *EMBO J.* 10:1777-1786 (1991); and Zhang *et al.*, *Plant J.* 4:711-716 (1993), all of which are herein incorporated by reference in their entirety). Both half sites are involved in the binding of the bZIP protein, GBF1, a member of the family *Arabidopsis thaliana*. The bZIP protein has been characterized in at least 19 other plant species (Erlich *et al.*, *Gene* 117:169-178 (1992); Foley *et al.*, *Plant J.* 3: 669-679 (1993); Guiltinan *et al.*, *Science* 250:267-271 (1990); Kawata *et al.*, *Nucl. Acids Res.* 20:1141 (1992); Katagiri *et al.*, *Nature* 340:727-730 (1989); Odea *et al.*, *EMBO J.* 10:1793-1991 (1991); Pysh *et al.*, *Plant Cell* 5:227-236 (1993); Schindler *et al.*, *Plant Cell* 4:1309-1319 (1992); Schmidt *et al.*, *Proc. Natl. Acad. Sci. (USA)* 87:46-50 (1990); Singh *et al.*, *Plant Cell* 2: 891-903 (1990); Tabata

et al., *EMBO J.* 10:1459-1467 (1991); Tabata *et al.*, *Science* 245:965-967 (1989); Weisshaar *et al.*, *EMBO J.* 10:1777-1786 (1991); Zhang *et al.*, *Plant J.* 4:711-716 (1993), all of which are herein incorporated by reference in their entirety). Each of these proteins recognizes DNA sequences that share the central core sequence ACGT. bZIP transcription factors are characterized by the presence of a basic domain and a leucine zipper.

Plant bZIP proteins have been shown to bind regulatory elements from a wide variety of inducible plant genes including those regulated by cell cycle, light, UV light, drought and pathogen infections (Ehrlich *et al.*, *Gene* 117: 169-178 (1992), Donald *et al.*, *EMBO J.* 9:1727-1735 (1990); Guiltinan *et al.*, *Science* 250:267-271 (1990); Katagiri *et al.*, *Nature* 340:727-730 (1989); Oeda *et al.*, *EMBO J.* 10: 1793-1991 (1991), the entirety of which is herein incorporated by reference; Tabata *et al.*, *EMBO J.* 10:1459-1467 (1991); Weisshaar *et al.*, *EMBO J.* 10:1777-1786 (1991); Holdworth *et al.*, *Plant Molecular Biology* 29: 711-720 (1995), the entirety of which is herein incorporated by reference; Mikami *et al.*, *Mol. Gen. Genet.* 248: 573-582 (1995), the entirety of which is herein incorporated by reference).

Specific transcription factors contribute to the quantitative and qualitative gene expression within a cell. The activity of a given transcription factors can effect cell physiology, metabolism, and/or the cell's ability to differentiate and communicate or associate with other cells within an organism. The regulation of the transcription of a gene may be the result of the activity of one or more transcription factors. Transcription factors are involved in the regulation of constitutive expression, inducible expression (such as expression in response to an environmental stimuli), and developmentally regulated expression.

Transcription factor gene families have been reported in plants (Martin and Paz-Ares, *Trends in Genetics* 13: 43-84 (1997), the entirety of which is herein incorporated by reference;

1259-1269 (1995), the entirety of which is herein incorporated by reference; Heck *et al.*, *Plant Cell* 7: 1271-1282 (1995), the entirety of which is herein incorporated by reference; Perry *et al.*, *Plant Cell* 8: 1977-1989 (1996), the entirety of which is herein incorporated by reference; Bradley *et al.*, *Cell* 72: 85-95 (1993), the entirety of which is herein incorporated by reference; Huijser *et al.*, *EMBO J.* 11: 1239-1249 (1992), the entirety of which is herein incorporated by reference; Sommer *et al.*, *EMBO J.* 9: 605-613 (1990), the entirety of which is herein incorporated by reference; Trober *et al.*, *EMBO J.* 11: 4693-4704 (1992), the entirety of which is herein incorporated by reference; Schwarz-Sommer *et al.*, *EMBO J.* 11: 251-263 (1992), the entirety of which is herein incorporated by reference; Davies *et al.*, *EMBO J.* 15: 4330-4343 (1996), the entirety of which is herein incorporated by reference; Zachgo *et al.*, *Development* 121: 2861-2875 (1995), the entirety of which is herein incorporated by reference; Tsuchimoto *et al.*, *Plant Cell* 5: 843-853 (1993), the entirety of which is herein incorporated by reference; Angenent *et al.*, *Plant J.* 5: 33-44 (1993), the entirety of which is herein incorporated by reference; Van der Krol *et al.*, *Genes and Development* 7: 1214-1228 (1993), the entirety of which is herein incorporated by reference; Angenent *et al.*, *Plant Cell* 7: 505-516 (1995), the entirety of which is herein incorporated by reference; Angenent *et al.*, *Plant Cell* 4: 983-993 (1992), the entirety of which is herein incorporated by reference; Angenent *et al.*, *Plant J.* 5: 33-44 (1994), the entirety of which is herein incorporated by reference; Angenent *et al.*, *Plant J.* 4: 101-112 (1993), the entirety of which is herein incorporated by reference; Angenent *et al.*, *Plant Cell* 7: 1569-1582 (1995), the entirety of which is herein incorporated by reference; Columbo *et al.*, *Plant Cell* 7: 1859-1868 (1995), the entirety of which is herein incorporated by reference).

MADS-box transcription factors have been shown to bind to DNA and alter transcription by both induction and repression. Examples are known where MADS-box transcription factors

exert their transcriptional regulation by binding and interacting individually, as homodimers or heterodimers, or through heterologous associations with non-MADS-box transcription factors. However, MADS transcription factors typically form dimers (Riechmann and Meyerowitz, *Bio. Chem.* 378: 1079-1101 (1997). MADS box transcription factors are defined by the signature MADS domain which is the most highly conserved portion of the protein among all the family members. In plants, additional domains (the I region, K-domain, and C-terminal region, in linear order) have been reported which are characteristic of the plant specific branch of this family.

The MADS domain is an approximately 57 amino acid domain located at or near the N-terminal portion of the MADS-box transcription factor (with approximately 260 amino acids in the total protein). This domain is highly conserved and is the most uniquely defining element of the family. For example, two homologues, APETALA1 from *Arabidopsis* and ZAP1 from *Zea mays*, show 89% identity over MADS domain. Conservation of this domain may be linked to its function as the portion of the protein that directly interacts with the target DNA binding site. The MADS domain is responsible for specifically binding DNA at A-T rich sequences referred to as CArG-boxes, whose consensus sequence has been reported as CC(A/T)₆GG (Shore and Sharrocks, *Eur. J. Bioiochem.* 229: 1-13 (1995), the entirety of which is herein incorporated by reference).

The I domain spans approximately 30 amino acid sequence of poor sequence conservation compared to the MADS-domain. The intervening-region links the MADS domain region with the K-domain. Its length and sequence is variable and may be absent from some family members.

The K domain is an approximately 70 amino acid domain that is unique to the plant family members of the MADS-box gene superfamily. It is found in the majority of plant MADS-

box genes. It has weak similarity to portions of animal keratin and is predicted to form amphipathic alpha helices which may facilitate interaction with other proteins. It has been reported that the structural conformation of this domain is a contributing constraint on conservation of this sequence. The K-domain typically exhibits less overall amino acid conservation than the MADS-domain, but between homologue genes such as APETALA1 from *Arabidopsis* and ZAP1 from *Zea mays*, this similarity can still be high (approximately 70%).

The C terminal domain, along with the I-domain, is the least conserved portions of the MADS-box gene family member in plants. Although exact functions for this approximately 90-100 amino acid domain have not been determined, there are known mutations within this region that lead to distinct developmental abnormalities in plants which indicate a role in transcriptional regulation. Conservation of this domain increases with increasing evolutionary closeness of species and homologues under comparison.

Genetic and molecular analysis have shown that transcription factors belonging to the MADS transcription factor family, at least in part, regulate diverse functions (Riechmann and Meyerowitz, *Bio. Chem.* 378: 1079-1101 (1997). MADS transcription factors often exert their effect in a homeotic manner (e.g. loss of AG activity (a MADS transcription factor) in *Arabidopsis* homeotically transforms the third and fourth whorl organs and eliminates floral determinacy) (Mena *et al.*, *Science* 274: 1537-1540 (1996), the entirety of which is herein incorporated by reference). MADS transcription factors can regulate different processes. For example, the role of certain MADS transcription factors in floral development is reviewed in Riechmann and Meyerowitz, *Bio. Chem.* 378: 1079-1101 (1997). MADS transcription factors are also involved in the regulation of other plant processes such as phytochrome regulation (Wang *et al.*, *Plant Cell* 9: 491-507 (1997), the entirety of which is herein incorporated by

reference) and seed development (Colombo *et al.*, *Plant Cell* 9: 703-715 (1997), the entirety of which is herein incorporated by reference).

Another family of transcription factors found in plants are MYB transcription factors. MYB transcription factors generally contain three repeats (R1, R2 and R3). The MYB DNA binding domain of plant proteins usually consists of two imperfect repeats of about 50 residues (Baranowskij *et al.*, *EMBO J.* 13: 5383-5392 (1994), the entirety of which is herein incorporated by reference). MYB transcription factors exhibit a helix-turn-helix motif (Ogata *et al.*, *Cell* 79: 639-648 (1994), the entirety of which is herein incorporated by reference). The DNA binding specificity of plant MYB proteins differs. For example, the maize P protein recognizes the motif [C/A]TCC[T/A]ACC similar to that bound by AmMYB305 from *Antirrhinum*, and neither of these proteins appears to bind to the similar vertebrate MYB consensus motif (TAACNG) (Grotewold *et al.*, *Cell* 76: 543-553 (1994), the entirety of which is herein incorporated by reference; Solano *et al.*, *EMBO J.* 14: 1773-1784 (1995), the entirety of which is herein incorporated by reference). Small changes in the amino acid sequence of a MYB transcription factor can alter the DNA binding properties of that transcription factor. For example, PMYB3 from *Petunia* binds to two sequences, MBSI (TAAC[C/G] GTT) and MBSII (TAACTAAG) (Solano *et al.*, *EMBO J.* 14: 1773-1784 (1995)). In the case of PMYB3, it has been shown that a substitution of a single residue in the R2 recognition helix switches the dual DNA-binding specificity to that of c-MYB, and the reciprocal substitution in c-MYB gives dual DNA-binding specificity similar to PhMYB3.

Mutations in residues that do not contact bases may also effect sequence-specific binding and have been reported to account for some of the differences in DNA-binding specificity between plant MYB proteins (Suzuki, *Proc Jap. Acad. Series B* 71: 27-31 (1995), the entirety of

which is herein incorporated by reference). Of the eight putative base-contacting residues in MYB proteins, six are fully conserved in all plant MYB proteins, and the remaining two are conserved in at least 80% of these proteins. Nonetheless MYB transcription factors exhibit different nucleic acid sequence specificities and different strengths of contacts (Solano *et al.*, *Plant J.* 8: 673-682 (1995), the entirety of which is herein incorporated by reference). In addition, temporal patterns of accumulation of RNA of different plant *MYB* genes may be effected by environmental stimuli, such as light, salt stress or the plant hormones, gibberellic acid and abscisic acid (Urao *et al.*, *Plant Cell* 5: 1529-1539 (1993); Jackson *et al.*, *Plant Cell* 3: 115-125 (1991), the entirety of which is herein incorporated by reference; Cone *et al.*, *Plant Cell* 5: 1795-1805 (1993), the entirety of which is herein incorporated by reference; Noda *et al.*, *Nature* 369: 661-664 (1994); Larkin *et al.*, *Plant Cell* 5: 1739-1748 (1993), the entirety of which is herein incorporated by reference; Gubler *et al.*, *Plant Cell* 7: 1879-1891 (1995), the entirety of which is herein incorporated by reference; Hattari *et al.*, *Genes Dev.* 6: 609-618 (1992), the entirety of which is herein incorporated by reference).

In plants distinct functions for different MYB transcription factors have been reported including controlling secondary metabolism, regulation of cellular morphogenesis and the signal transduction pathways. MYB proteins are reported to play a role in the control of phenylpropanoid metabolism. Phenylpropanoid metabolism is one of the three main types of secondary metabolism in plants involving modification of compounds derived initially from phenylalanine. Through one branch (flavonoid metabolism) it is responsible for the production of a majority group of plant pigments (the anthocyanins) and other minor groups (aurones and phlobaphenes) and it also produces compounds that modify pigmentation through chemical interaction with the anthocyanins (co-pigmentation), such as the flavones and flavonols.

Flavones and flavonols also serve to absorb ultraviolet light to protect plants. Several flavanoids act as signalling molecules in legumes inducing gene expression in symbiotic bacteria in a species-specific manner, and others act as factors required for pollen maturation and pollen germination in some plant species. A number of flavanoids and related phenylpropanoids (such as stilbenes) also act as defensive agents (phytoalexins) against biotic and abiotic stresses in particular plant species. Another branch of phenylpropanoid metabolism produces the precursors for production of lignin, the strengthening and waterproofing material of plant vascular tissue and one of the principal components of wood. This branch also produces other soluble phenolics, which can serve as signalling molecules, cell-wall crosslinking agents and antioxidants.

The C1 transcription factor (a MYB transcription factor) activates transcription of genes encoding enzymes involved in the biosynthesis of the anthocyanin pigments in the outer layer of cells of the maize seed endosperm (the aleurone)(Paz-Ares *et al.*, *EMBO J.* 5: 829-833 (1986) Cone *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 83: 9631-9635 (1986), both of which are herein incorporated by reference in their entirety). Activation has been reported for at least five genes in the pathway to anthocyanin. Activation by C1 involves a partner transcriptional activator found in aleurone, a protein similar to a MYB transcription factor. These proteins also interact with other members of the R-protein family to regulate anthocyanin biosynthetic gene expression (Cone *et al.*, *Plant Cell* 5: 1795-1805 (1993)). For example, in maize, another MYB protein, ZmMYB1, can activate one of the structural genes required for anthocyanin production (Franken *et al.*, *Plant J.* 6: 21-30 (1994), the entirety of which is herein incorporated by reference), while yet another, ZmMYB38, inhibits C1-mediated activation of the same promoter.

Reiteration of MYB-gene function reportedly occurs in the control of a branch of flavonoid metabolism producing the red phlobaphene pigments from intermediates in flavonoid metabolism. This pathway is under control of the *P* gene in maize, which encodes a MYB-related protein (Grotewold *et al.*, *Cell* 76: 543-553 (1994)). The *P* gene product activates a subset of the genes involved in anthocyanin biosynthesis. The P-binding site is contained within the promoters of these target genes (Li and Parish, *Plant J.* 8: 963-972 (1995), the entirety of which is herein incorporated by reference). In maize, at least two different MYB proteins serve to direct flavonoid metabolism along different routes by selective activation of target genes.

In other plant species MYB proteins can serve similar roles in the control of phenylpropanoid metabolism as, for example, in *Petunia* flowers. MYB proteins can also serve to regulate other branches of phenylpropanoid metabolism. In *Antirrhinum majus* and tobacco AmMYB305 (or its homologue in tobacco) can activate the gene encoding the first enzyme of phenylpropanoid metabolism, phenylalanine ammonia lyase (PAL (Urao *et al.*, *Plant Cell* 5: 1529-1539 (1993))). Some *MYB* genes have been shown to be highly expressed in tissues such as differentiating xylem and may act to influence the branch of phenylpropanoid metabolism involved in lignin production (Campbell *et al.*, *Plant Physiol.* 108 (Suppl.), 28 (1995), the entirety of which is herein incorporated by reference).

A second reported role for plant *MYB* genes is in the control of cell shape. For example, the *MLXTA* gene of *Antirrhinum* and the homologue *PhMYB1* gene from *Petunia* have been shown to play a role in the development of the conical form of petal epidermal cells and the *GL1* gene of *Arabidopsis* has been shown to be essential for the differentiation of hair cells (trichomes) in some parts of the leaf and in the stem (Noda *et al.*, *Nature* 369: 661-664 (1994); Oppenheimer *et al.*, *Cell* 67: 483-493 (1991), the entirety of which is herein incorporated by

reference; Mur, PhD Thesis, Vrije Univ. of Amsterdam (1995), the entirety of which is herein incorporated by reference). Overexpression of *MIXTA* in transgenic tobacco results in trichome formation on pedals, suggesting that conical petal cells might be 'trichoblasts' arrested at an early stage in trichome formation.

GLI of *Arabidopsis* is associated with the expansion in the size of the cell that develops into the trichome, and it acts upstream of a number of other genes (Huiskamp *et al.*, *Cell* 76: 555-566 (1994), the entirety of which is herein incorporated by reference). GLI mutants can exhibit cellular outgrowths that do not develop into full branched trichomes. *GL2* of *Arabidopsis* encodes a homeodomain protein that is associated with trichome development (Rerie *et al.*, *Genes Dev.* 8: 1388-1399 (1994), the entirety of which is herein incorporated by reference). The *GL2* gene promoter contains motifs very similar to the binding sites of P and AmMYB305 transcription factors (Rerie *et al.*, *Genes Dev.* 8: 1388-1399 (1994)).

The conical cells produced by the action of the *MIXTA* gene of *Antirrhinum* resemble the limited outgrowths produced in *Arabidopsis gl2* mutants where trichome formation is aborted. In its regulation of trichome formation, GL1 interacts with the product of the *TTG* gene, which is required for trichome formation and anthocyanin production (Lloyd *et al.*, *Science* 258: 1773-1775 (1992), the entirety of which is herein incorporated by reference). Expression of the maize *R* gene complements the *ttg* mutation and it has been reported that the *TTG* gene product is also a R-related protein that interacts with GL1 in a manner analogous to the interaction of C1 and R in maize (Lloyd *et al.*, *Science* 258: 1773-1775 (1992)).

A further reported role for plant MYB proteins is in hormonal responses during seed development and germination. A barley MYB protein (GAMY) whose expression is induced by

gibberellic acid (GA) has been shown to activate expression of a gene encoding a high pI α -amylase that is synthesized in barley aleurone upon germination for the mobilization of starch in the endosperm (Larkin *et al.*, *Plant Cell* 5: 1739-1748 (1993)). Expression of GAMYB is induced by treatment of aleurone layers with GA and expression of the α -amylase gene is induced subsequently. There is a suggestion that other GA-inducible genes can also respond to activation by MYB proteins during seed germination because MYB-like motifs from other GA-responsive gene promoters have been shown to direct reporter gene expression in response to GA (Larkin *et al.*, *Plant Cell* 5: 1739-1748 (1993)). In addition, some MYB genes are expressed in response to GA treatment of *Petunia* petals (Mur, Ph.D. Thesis, Vrije Univ. of Amsterdam (1995)).

Treatment with another plant hormone, abscisic acid (ABA), induces expression of *AtMYB2* in *Arabidopsis*, a MYB gene that is also induced in response to dehydration or salt stress (Shinozaki *et al.*, *Plant Mol.* 19: 439-499 (1992), the entirety of which is herein incorporated by reference). In maize, expression of the C1 gene is also ABA-responsive, where it is involved in the formation of anthocyanin in the developing kernels (Larkin *et al.*, *Plant Cell* 5: 1739-1748 (1993)). The *rd22* gene promoter contains MYC-recognition sequences suggesting that *AtMYB2* can interact with a bHLH protein to induce gene transcription in response to dehydration or salt stress (Iwasaki *et al.*, *Mol. Gen. Genet.* 247: 391-398 (1995), the entirety of which is herein incorporated by reference).

Plant transcription factors that fall within the helix-loop-helix class of transcription factors have been reported. These include the transcription factor encoded by the *Zea mays* *R* and *B* class gene (Radicella *et al.*, *Genes and Development* 6: 2152-2164 (1992), the entirety of

which is herein incorporated by reference). Alleles that have been identified at the *b* and *r* loci show differences in developmental or tissue specific expression.

Homeodomain transcription factors have been isolated from different plant species (Ma *et al.*, *Plant. Molec. Biol.* 24: 465-473 (1994), the entirety of which is herein incorporated by reference; Muller *et al.*, *Nature* 374: 727 (1995), the entirety of which is herein incorporated by reference; Lincoln *et al.*, *Plant Cell* 6: 1859-1876 (1994), entirety of which is herein incorporated by reference; Hareven *et al.*, *Cell* 84: 735-744 (1996), entirety of which is herein incorporated by reference; Vollbrecht *et al.*, *Nature* 350: 241-243 (1991)).

The homeodomain contains three α -helices (Quain *et al.*, *Cell* 59: 573-580 (1989), the entirety of which is herein incorporated by reference). Residues in helix 3 contact the major groove of a nucleic acid in a sequence specific manner. Although structurally similar, different homeodomains are able to recognize diverse binding sites (Hanes *et al.*, *Cell* 57: 1275-1283 (1989), the entirety of which is herein incorporated by reference; Treisamn *et al.*, *Genes Dev.* 5: 594-604 (1991), the entirety of which is herein incorporated by reference; Affolter *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 87: 4093-4097 (1990), the entirety of which is herein incorporated by reference; Percival-Smith *et al.*, *EMBO J.* 9: 3967-3974 (1990), the entirety of which is herein incorporated by reference).

One class of homeodomain transcription factors are those that share a conserved cysteine-rich motif as illustrated by the *Arabidopsis* GLABRA2 homeodomain protein and the *Zea mays* KNOTTED1 (KN1)-like proteins (Vollbrecht *et al.*, *Nature* 350: 241-243 (1991), Ma *et al.*, *Plant. Molec. Biol.* 24: 465-473 (1994)). The morphological mutation *Knotted1* in *Zea mays* alters the developmental fate of cells in leaf blades with wild-type expression of the gene

localized in the meristem and ground tissue but absent from leaves or leaf primordia (Hake, *Trends in Genetics* 8:109-114 (1992), the entirety of which is herein incorporated by reference; Freeling and Hake, *Genetics* 111: 617-634 (1995), the entirety of which is herein incorporated by reference). In addition to having a homeodomain, the *kn1* class of genes in *Zea mays* encode an ELK domain which contains repeating hydrophobic residues (Kerstetter *et al.*, *Plant Cell* 6: 1877-1887 (1994), the entirety of which is herein incorporated by reference).

Kn1-like homeodomain genes have been reported in other plants, such as *Arabidopsis* (Lincoln *et al.*, *Plant Cell* 6: 1859-1876 (1994), the entirety of which is herein incorporated by reference), tomato and soybean (Ma *et al.*, *Plant Molecular Biology* 24: 465-473 (1994), the entirety of which is herein incorporated by reference).

Homeodomain transcription factors have been associated with the regulation of cell to cell communication and development in plants. Presence of the KNOTTED1 homeodomain transcription factor in a plant cell can lead to an increase in plasmodesmal size permitting the transport of larger molecules between cells (Lucas *et al.*, *Science* 270: 1980-1983 (1995), the entirety of which is herein incorporated by reference).

Another class of transcription factors, the polycomb-like transcription factors, have been reported in plants (Goodrich *et al.*, *Nature* 386: 44-51 (1997), the entirety of which is herein incorporated by reference). Wild type CLF, a polycomb-like transcription factor, isolated from *Arabidopsis*, exhibits extensive structural homology with *Drosophila* Pc-G genes plants (Goodrich *et al.*, *Nature* 386: 44-51 (1997)). Like *Drosophila* Pc-G genes, the CLF genes encodes for a SET domain and two cysteine rich regions. CLF, while not being necessary for initial specification of stamen and carpel development, is reportedly necessary to later stages of development plants and represses a second transcription factor AGAMOUS (Goodrich *et al.*,

Nature 386: 44-51 (1997); Schumacher and Magnuson, *Trends in Genetics* 13(5): 167-170 (1997), the entirety of which is herein incorporated by reference).

A further class of transcription factors, those containing an AP2 domain, a conserved motif first identified in *Arabidopsis* (a floral mutant), has been identified in a number of plants (Jofuka *et al.*, *Plant Cell* 6: 1211-1225 (1994), the entirety of which is herein incorporated by reference; Weigal *et al.*, *Plant Cell* 7: 388-389 (1995), the entirety of which is herein incorporated by reference). The AP2 domain, which is a DNA-binding motif of about 60 amino acid has been reported, for example, to be present in the *Arabidopsis* transcription factors CBF1, APETALA2, AINTEGUMENTA, and TINY; as well as the tobacco ethylene response element binding proteins (Moose and Sisco, *Genes and Development* 10: 3018-3027 (1996), the entirety of which is herein incorporated by reference). Weigal *et al.*, reports a 24 amino acid AP2 consensus domain which is predicted to form an amphipathic α -helix that may mediate protein-protein interactions (Weigal *et al.*, *Plant Cell* 7: 388-389 (1995)).

Mutations of transcription factors containing an AP2 domain have been to effect floral and ovule development (Meyerowitz *et al.*, *Cell* 88: 299-308 (1997), the entirety of which is herein incorporated by reference). Other transcription factors from this family have been reported to play a role in cold- and dehydration-regulated gene expression (Stockinger *et al.*, *Proc Natl. Acad. Sci. (U.S.A.)* 94(3): 035-1040 (1997), the entirety of which is herein incorporated by reference).

Zinc-finger proteins have been isolated from plants (Takatsuji and Matsumoto, *J. Biol. Chem.* 271: 23368-23373 (1996), the entirety of which is herein incorporated by reference; Messner, *Plant Mol. Biol.* 33: 615-624 (1997), the entirety of which is herein incorporated by

reference; Dietrich *et al.*, *Cell* 88: 685-694 (1997), the entirety of which is herein incorporated by reference; Pater *et al.*, *Nucleic Acid Research* 24: 4624-4631 (1996), the entirety of which is herein incorporated by reference; Tague and Goodman, *Plant Mole. Biol.* 28: 267-279 (1995), the entirety of which is herein incorporated by reference; Putterill *et al.*, *Cell* 80: 847-857 (1995), the entirety of which is herein incorporated by reference; Takatsuji *et al.*, *Plant Cell* 6: 947-958 (1994), the entirety of which is herein incorporated by reference). Zinc-finger proteins have been associated with a number of processes in plants including cell death (Dietrich *et al.*, *Cell* 88: 685-694 (1997)) and flower morphology (Pater *et al.*, *Nucleic Acid Research* 24: 4624-4631 (1996)).

The term zinc-finger has been applied to a broad set of protein motifs. Zinc-finger transcription factors may be subdivided into a number of categories. A category of zinc-finger transcription factors referred to as the C₂H₂ zinc finger transcription factors (also referred to as either TFIIA or Krüppel-like zinc fingers)(Meissner and Michael, *Plant Molecular Biology* 33: 615-624 (1997); Takatsuji *et al.*, *EMBO J.* 11: 241-249 (1994), the entirety of which is herein incorporated by reference; Tague and Goodman, *Plant Mol. Biol.* 28: 267-279 (1995); Takasuji *et al.*, *Plant Cell* 6: 947-948 (1994), Sakamoto *et al.*, *Eur. J. Biochem.* 217: 1049-1056 (1993), the entirety of which is herein incorporated by reference; Saki *et al.*, *Nature* 378: 199-203 (1995), the entirety of which is herein incorporated by reference). C₂H₂ zinc finger transcription factors have been reported, which contain one, two or three zinc fingers. These zinc fingers are maintained by cysteine and/or histidine residues organized around a zinc metal ion (Meissner and Michael, *Plant Molecular Biology* 33: 615-624 (1997)).

Examples of C₂H₂ zinc finger transcription factors include: the petunia Epf1 product which binds to an inverted repeat found in the promoter of EPSP, the W2f1 product from wheat, which binds to a nonameric motif found in the histone H3 promoter; the *Arabidopsis* AtZFP1

product associated with shoot development; and the *Arabidopsis* SUPERMAN product that is associated with negative regulation of B-function floral organ identity (Meissner and Michael, *Plant Molecular Biology* 33: 615-624 (1997); Takatsuji *et al.*, *EMBO J.* 11: 241-249 (1994); Tague and Goodman, *Plant Mol. Biol.* 28: 267-279 (1995); Takasuji *et al.*, *Plant Cell* 6: 947-948 (1994), Sakamoto *et al.*, *Eur. J. Biochem.* 217: 1049-1056 (1993); Saki *et al.*, *Nature* 378: 199-203 (1995)).

Another category of zinc-finger transcription factor include plant relatives of the GATA-1 transcription factor (Dietrich *et al.*, *Cell* 88: 685-694 (1997); Evans and Felsenfeld *Cell* 58: 877-885 (1989), the entirety of which is herein incorporated by reference; Putterill *et al.*, *Cell* 80: 847-857 (1995); Yanagisawa *et al.*, *Nucleic Acid Research* 23: 3403-3410 (1995), the entirety of which is herein incorporated by reference; De Paolis *et al.*, *Plant J.* 10: 215-224 (1996), the entirety of which is herein incorporated by reference; Lippuner *et al.*, *J. Biol. Chem.* 271: 12859-12866 (1996), the entirety of which is herein incorporated by reference). GATA-1 like transcription factors have been associated with, for example, the regulation of cell death and the regulation of expression associated with salt stress.

II. EXPRESSED SEQUENCE TAG NUCLEIC ACID MOLECULES

Expressed sequence tags, or ESTs are randomly sequenced members of a cDNA library (or complementary DNA)(McCombie *et al.*, *Nature Genetics* 1:124-130 (1992); Kurata *et al.*, *Nature Genetics* 8:365-372 (1994); Okubo *et al.*, *Nature Genetics* 2:173-179 (1992), all of which references are incorporated herein in their entirety). The randomly selected clones comprise insets that can represent a copy of up to the full length of a mRNA transcript.

Using conventional methodologies, cDNA libraries can be constructed from the mRNA (messenger RNA) of a given tissue or organism using poly dT primers and reverse transcriptase

(Efstratiadis *et al.*, *Cell* 7:279-3680 (1976), the entirety of which is herein incorporated by reference; Higuchi *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 73:3146-3150 (1976), the entirety of which is herein incorporated by reference; Maniatis *et al.*, *Cell* 8:163-182 (1976) the entirety of which is herein incorporated by reference; Land *et al.*, *Nucleic Acids Res.* 9:2251-2266 (1981), the entirety of which is herein incorporated by reference; Okayama *et al.*, *Mol. Cell. Biol.* 2:161-170 (1982), the entirety of which is herein incorporated by reference; Gubler *et al.*, *Gene* 25:263-269 (1983), the entirety of which is herein incorporated by reference).

Several methods may be employed to obtain full-length cDNA constructs. For example, terminal transferase can be used to add homopolymeric tails of dC residues to the free 3' hydroxyl groups (Land *et al.*, *Nucleic Acids Res.* 9:2251-2266 (1981), the entirety of which is herein incorporated by reference). This tail can then be hybridized by a poly dG oligo which can act as a primer for the synthesis of full length second strand cDNA. Okayama and Berg, *Mol. Cell. Biol.* 2:161-170 (1982), the entirety of which is herein incorporated by reference, report a method for obtaining full length cDNA constructs. This method has been simplified by using synthetic primer-adapters that have both homopolymeric tails for priming the synthesis of the first and second strands and restriction sites for cloning into plasmids (Coleclough *et al.*, *Gene* 34:305-314 (1985), the entirety of which is herein incorporated by reference) and bacteriophage vectors (Krawinkel *et al.*, *Nucleic Acids Res.* 14:1913 (1986), the entirety of which is herein incorporated by reference; Han *et al.*, *Nucleic Acids Res.* 15:6304 (1987), the entirety of which is herein incorporated by reference).

These strategies have been coupled with additional strategies for isolating rare mRNA populations. For example, a typical mammalian cell contains between 10,000 and 30,000 different mRNA sequences (Davidson, *Gene Activity in Early Development*, 2nd ed., Academic

Press, New York (1976), the entirety of which is herein incorporated by reference). The number of clones required to achieve a given probability that a low-abundance mRNA will be present in a cDNA library is $N = (\ln(1-P))/(\ln(1-1/n))$ where N is the number of clones required, P is the probability desired and 1/n is the fractional proportion of the total mRNA that is represented by a single rare mRNA (Sambrook *et al.*, *Molecular Cloning: A Laboratory Manual*, 2nd ed., Cold Spring Harbor Laboratory Press (1989), the entirety of which is herein incorporated by reference).

A method to enrich preparations of mRNA for sequences of interest is to fractionate by size. One such method is to fractionate by electrophoresis through an agarose gel (Pennica *et al.*, *Nature* 301:214-221 (1983), the entirety of which is herein incorporated by reference). Another such method employs sucrose gradient centrifugation in the presence of an agent, such as methylmercuric hydroxide, that denatures secondary structure in RNA (Schweinfest *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 79:4997-5000 (1982), the entirety of which is herein incorporated by reference).

A frequently adopted method is to construct equalized or normalized cDNA libraries (Ko, *Nucleic Acids Res.* 18:5705-5711 (1990), the entirety of which is herein incorporated by reference; Patanjali *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 88:1943-1947 (1991), the entirety of which is herein incorporated by reference). Typically, the cDNA population is normalized by subtractive hybridization (Schmid *et al.*, *J. Neurochem.* 48:307-312 (1987), the entirety of which is herein incorporated by reference; Fargnoli *et al.*, *Anal. Biochem.* 187:364-373 (1990), the entirety of which is herein incorporated by reference; Travis *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 85:1696-1700 (1988), the entirety of which is herein incorporated by reference; Kato, *Eur. J. Neurosci.* 2:704-711 (1990); and Schweinfest *et al.*, *Genet. Anal. Tech. Appl.* 7:64-70 (1990), the

entirety of which is herein incorporated by reference). Subtraction represents another method for reducing the population of certain sequences in the cDNA library (Swaroop *et al.*, *Nucleic Acids Res.* 19:1954 (1991), the entirety of which is herein incorporated by reference).

ESTs can be sequenced by a number of methods. Two basic methods may be used for DNA sequencing, the chain termination method of Sanger *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 74:5463-5467 (1977), the entirety of which is herein incorporated by reference and the chemical degradation method of Maxam and Gilbert, *Proc. Nat. Acad. Sci. (U.S.A.)* 74:560-564 (1977), the entirety of which is herein incorporated by reference. Automation and advances in technology such as the replacement of radioisotopes with fluorescence-based sequencing have reduced the effort required to sequence DNA (Craxton, *Methods* 2:20-26 (1991), the entirety of which is herein incorporated by reference; Ju *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 92:4347-4351 (1995), the entirety of which is herein incorporated by reference; Tabor and Richardson, *Proc. Natl. Acad. Sci. (U.S.A.)* 92:6339-6343 (1995), the entirety of which is herein incorporated by reference). Automated sequencers are available from, for example, Pharmacia Biotech, Inc., Piscataway, New Jersey (Pharmacia ALF), LI-COR, Inc., Lincoln, Nebraska (LI-COR 4,000) and Millipore, Bedford, Massachusetts (Millipore BaseStation).

In addition, advances in capillary gel electrophoresis have also reduced the effort required to sequence DNA and such advances provide a rapid high resolution approach for sequencing DNA samples (Swerdlow and Gesteland, *Nucleic Acids Res.* 18:1415-1419 (1990); Smith, *Nature* 349:812-813 (1991); Luckey *et al.*, *Methods Enzymol.* 218:154-172 (1993); Lu *et al.*, *J. Chromatog. A.* 680:497-501 (1994); Carson *et al.*, *Anal. Chem.* 65:3219-3226 (1993); Huang *et al.*, *Anal. Chem.* 64:2149-2154 (1992); Kheterpal *et al.*, *Electrophoresis* 17:1852-1859 (1996);

Quesada and Zhang, *Electrophoresis* 17:1841-1851 (1996); Baba, *Yakugaku Zasshi* 117:265-281 (1997), all of which are herein incorporated by reference in their entirety).

ESTs longer than 150 nucleotides have been found to be useful for similarity searches and mapping (Adams *et al.*, *Science* 252:1651-1656 (1991), herein incorporated by reference). ESTs, which can represent copies of up to the full length transcript, may be partially or completely sequenced. Between 150-450 nucleotides of sequence information is usually generated as this is the length of sequence information that is routinely and reliably produced using single run sequence data. Typically, only single run sequence data is obtained from the cDNA library (Adams *et al.*, *Science* 252:1651-1656 (1991). Automated single run sequencing typically results in an approximately 2-3% error or base ambiguity rate (Boguski *et al.*, *Nature Genetics* 4:332-333 (1993), the entirety of which is herein incorporated by reference).

EST databases have been constructed or partially constructed from, for example, *C. elegans* (McCombie *et al.*, *Nature Genetics* 1:124-131 (1992)), human liver cell line HepG2 (Okubo *et al.*, *Nature Genetics* 2:173-179 (1992)), human brain RNA (Adams *et al.*, *Science* 252:1651-1656 (1991); Adams *et al.*, *Nature* 355:632-635 (1992)), *Arabidopsis*, (Newman *et al.*, *Plant Physiol.* 106:1241-1255 (1994)); and rice (Kurata *et al.*, *Nature Genetics* 8:365-372 (1994)).

III. SEQUENCE COMPARISONS

A characteristic feature of a DNA sequence is that it can be compared with other DNA sequences. Sequence comparisons can be undertaken by determining the similarity of the test or query sequence with sequences in publicly available or proprietary databases ("similarity analysis") or by searching for certain motifs ("intrinsic sequence analysis")(e.g. *cis* elements)(Coulson, *Trends in Biotechnology* 12:76-80 (1994), the entirety of which is herein

incorporated by reference); Birren *et al.*, *Genome Analysis 1*: Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York 543-559 (1997), the entirety of which is herein incorporated by reference).

Similarity analysis includes database search and alignment. Examples of public databases include the DNA Database of Japan (DDBJ)(<http://www.ddbj.nig.ac.jp/>); Genebank (<http://www.ncbi.nlm.nih.gov/Web/Search/Index.html>); and the European Molecular Biology Laboratory Nucleic Acid Sequence Database (EMBL) (http://www.ebi.ac.uk/ebi_docs/embl_db/embl-db.html). Other appropriate databases include dbEST (<http://www.ncbi.nlm.nih.gov/dbEST/index.html>), SwissProt (http://www.ebi.ac.uk/ebi_docs/swisprot_db/swisshome.html), PIR (<http://www-nbrt.georgetown.edu/pir/>) and The Institute for Genome Research (<http://www.tigr.org/tdb/tdb.html>)

A number of different search algorithms have been developed, one example of which are the suite of programs referred to as BLAST programs. There are five implementations of BLAST, three designed for nucleotide sequences queries (BLASTN, BLASTX and TBLASTX) and two designed for protein sequence queries (BLASTP and TBLASTN) (Coulson, *Trends in Biotechnology* 12:76-80 (1994); Birren *et al.*, *Genome Analysis 1*, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York 543-559 (1997)).

BLASTN takes a nucleotide sequence (the query sequence) and its reverse complement and searches them against a nucleotide sequence database. BLASTN was designed for speed, not maximum sensitivity and may not find distantly related coding sequences. BLASTX takes a nucleotide sequence, translates it in three forward reading frames and three reverse complement reading frames and then compares the six translations against a protein sequence database.

BLASTX is useful for sensitive analysis of preliminary (single-pass) sequence data and is tolerant of sequencing errors (Gish and States, *Nature Genetics* 3:266-272 (1993), the entirety of which is herein incorporated by reference). BLASTN and BLASTX may be used in concert for analyzing EST data (Coulson, *Trends in Biotechnology* 12:76-80 (1994); Birren *et al.*, *Genome Analysis* 1:543-559 (1997)).

Given a coding nucleotide sequence and the protein it encodes, it is often preferable to use the protein as the query sequence to search a database because of the greatly increased sensitivity to detect more subtle relationships. This is due to the larger alphabet of proteins (20 amino acids) compared with the alphabet of nucleic acid sequences (4 bases), where it is far easier to obtain a match by chance. In addition, with nucleotide alignments, only a match (positive score) or a mismatch (negative score) is obtained, but with proteins, the presence of conservative amino acid substitutions can be taken into account. Here, a mismatch may yield a positive score if the non-identical residue has physical/chemical properties similar to the one it replaced. Various scoring matrices are used to supply the substitution scores of all possible amino acid pairs. A general purpose scoring system is the BLOSUM62 matrix (Henikoff and Henikoff, *Proteins* 17:49-61 (1993), the entirety of which is herein incorporated by reference), which is currently the default choice for BLAST programs. BLOSUM62 is tailored for alignments of moderately diverged sequences and thus may not yield the best results under all conditions. Altschul, *J. Mol. Biol.* 36:290-300 (1993), the entirety of which is herein incorporated by reference, describes a combination of three matrices to cover all contingencies. This may improve sensitivity, but at the expense of slower searches. In practice, a single BLOSUM62 matrix is often used but others (PAM40 and PAM250) may be attempted when additional analysis is necessary. Low PAM matrices are directed at detecting very strong but

localized sequence similarities, whereas high PAM matrices are directed at detecting long but weak alignments between very distantly related sequences.

Homologues in other organisms are available that can be used for comparative sequence analysis. Multiple alignments are performed to study similarities and differences in a group of related sequences. CLUSTAL W is a multiple sequence alignment package that performs progressive multiple sequence alignments based on the method of Feng and Doolittle, *J. Mol. Evol.* 25:351-360 (1987), the entirety of which is herein incorporated by reference. Each pair of sequences is aligned and the distance between each pair is calculated; from this distance matrix, a guide tree is calculated and all of the sequences are progressively aligned based on this tree. A feature of the program is its sensitivity to the effect of gaps on the alignment; gap penalties are varied to encourage the insertion of gaps in probable loop regions instead of in the middle of structured regions. Users can specify gap penalties, choose between a number of scoring matrices, or supply their own scoring matrix for both pairwise alignments and multiple alignments. CLUSTAL W for UNIX and VMS systems is available at: <ftp.ebi.ac.uk>. Another program is MACAW (Schuler *et al.*, *Proteins Struct. Func. Genet.* 9:180-190 (1991), the entirety of which is herein incorporated by reference, for which both Macintosh and Microsoft Windows versions are available. MACAW uses a graphical interface, provides a choice of several alignment algorithms and is available by anonymous ftp at: <ncbi.nlm.nih.gov> (directory/pub/macaw).

Sequence motifs are derived from multiple alignments and can be used to examine individual sequences or an entire database for subtle patterns. With motifs, it is sometimes possible to detect distant relationships that may not be demonstrable based on comparisons of primary sequences alone. Currently, the largest collection of sequence motifs in the world is

PROSITE (Bairoch and Bucher, *Nucleic Acid Research* 22:3583-3589 (1994), the entirety of which is herein incorporated by reference). PROSITE may be accessed via either the ExPASy server on the World Wide Web or anonymous ftp site. Many commercial sequence analysis packages also provide search programs that use PROSITE data.

A resource for searching protein motifs is the BLOCKS E-mail server developed by Henikoff, *Trends Biochem Sci.* 18:267-268 (1993), the entirety of which is herein incorporated by reference; Henikoff and Henikoff, *Nucleic Acid Research* 19:6565-6572 (1991), the entirety of which is herein incorporated by reference; Henikoff and Henikoff, *Proteins* 17:49-61 (1993). BLOCKS searches a protein or nucleotide sequence against a database of protein motifs or "blocks." Blocks are defined as short, ungapped multiple alignments that represent highly conserved protein patterns. The blocks themselves are derived from entries in PROSITE as well as other sources. Either a protein query or a nucleotide query can be submitted to the BLOCKS server; if a nucleotide sequence is submitted, the sequence is translated in all six reading frames and motifs are sought for these conceptual translations. Once the search is completed, the server will return a ranked list of significant matches, along with an alignment of the query sequence to the matched BLOCKS entries.

Conserved protein domains can be represented by two-dimensional matrices, which measure either the frequency or probability of the occurrences of each amino acid residue and deletions or insertions in each position of the domain. This type of model, when used to search against protein databases, is sensitive and usually yields more accurate results than simple motif searches. Two popular implementations of this approach are profile searches such as GCG program ProfileSearch and Hidden Markov Models (HMMs)(Krough *et al.*, *J. Mol. Biol.* 235:1501-1531, (1994); Eddy, *Current Opinion in Structural Biology* 6:361-365, (1996), both of

which are herein incorporated by reference in their entirety). In both cases, a large number of common protein domains have been converted into profiles, as present in the PROSITE library, or HMM models, as in the Pfam protein domain library (Sonnhammer *et al.*, *Proteins* 28:405-420 (1997), the entirety of which is herein incorporated by reference). Pfam contains more than 500 HMM models for enzymes, transcription factors, signal transduction molecules and structural proteins. Protein databases can be queried with these profiles or HMM models, which will identify proteins containing the domain of interest. For example, HMMSW or HMMFS, two programs in a public domain package called HMMER (Sonnhammer *et al.*, *Proteins* 28:405-420 (1997)) can be used.

PROSITE and BLOCKS represent collected families of protein motifs. Thus, searching these databases entails submitting a single sequence to determine whether or not that sequence is similar to the members of an established family. Programs working in the opposite direction compare a collection of sequences with individual entries in the protein databases. An example of such a program is the Motif Search Tool, or MoST (Tatusov *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 91:12091-12095 (1994), the entirety of which is herein incorporated by reference). On the basis of an aligned set of input sequences, a weight matrix is calculated by using one of four methods (selected by the user). A weight matrix is simply a representation, position by position of how likely a particular amino acid will appear. The calculated weight matrix is then used to search the databases. To increase sensitivity, newly found sequences are added to the original data set, the weight matrix is recalculated and the search is performed again. This procedure continues until no new sequences are found.

SUMMARY OF THE INVENTION

The present invention provides a substantially purified nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof, wherein the maize, soybean, or *Arabidopsis thaliana* transcription factor is selected from the group consisting of: (a) homeobox transcription factor (b) HLH transcription factor (c) leucine zipper transcription factor (d) zinc finger transcription factor and (e) other transcription factors.

The present invention also provides a substantially purified nucleic acid molecule that encodes a plant transcription factor or fragment thereof, wherein the nucleic acid molecule is selected from the group consisting of a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or fragment thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or fragment thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or fragment thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or fragment thereof and a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* other transcription factor or fragment thereof.

The present invention also provides a substantially purified maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof, wherein the maize or soybean transcription factor is selected from the group consisting of (a) homeobox transcription factor or fragment thereof; (b) HLH transcription factor or fragment thereof; (c) leucine zipper transcription factor or fragment thereof, (d) zinc finger transcription factor or fragment thereof and (e) other transcription factors or fragments thereof.

The present invention also provides a substantially purified maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof encoded by a first nucleic acid molecule which specifically hybridizes to a second nucleic acid molecule, the second nucleic acid molecule having a nucleic acid sequence selected from the group consisting of a complement of SEQ ID NO: 1 through SEQ ID NO: 3853.

The present invention also provides a substantially purified maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or fragment thereof encoded by a first nucleic acid molecule which specifically hybridizes to a second nucleic acid molecule, the second nucleic acid molecule having a nucleic acid sequence selected from the group consisting of a complement of SEQ ID NO: 1 through SEQ ID NO: 49, SEQ ID NO 1415 through SEQ ID NO: 1555 and SEQ ID NO: 1746 through SEQ ID NO: 2000.

The present invention also provides a substantially purified maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or fragment thereof encoded by a nucleic acid sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 49, SEQ ID NO 1415 through SEQ ID NO: 1555 and SEQ ID NO: 1746 through SEQ ID NO: 2000.

The present invention also provides a substantially purified maize, soybean or *Arabidopsis thaliana* HLH transcription factor or fragment thereof encoded by a first nucleic acid molecule which specifically hybridizes to a second nucleic acid molecule, the second nucleic acid molecule having a nucleic acid sequence selected from the group consisting of a complement SEQ ID NO: 50 through SEQ ID NO: 65, SEQ ID NO: 1724 through SEQ ID NO: 1745 and SEQ ID NO: 2001 through SEQ ID NO: 2085.

The present invention also provides a substantially purified maize, soybean or *Arabidopsis thaliana* HLH transcription factor or fragment thereof encoded by a nucleic acid

sequence selected from the group consisting of SEQ ID NO: 50 through SEQ ID NO: 65, SEQ ID NO: 1724 through SEQ ID NO: 1745 and SEQ ID NO: 2001 through SEQ ID NO: 2085.

The present invention also provides a substantially purified maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or fragment thereof encoded by a first nucleic acid molecule which specifically hybridizes to a second nucleic acid molecule, the second nucleic acid molecule having a nucleic acid sequence consisting of a complement of SEQ ID NO: 46 through SEQ ID NO: 47, SEQ ID NO: 66 through SEQ ID NO: 93, SEQ ID NO: 335, SEQ ID NO: 1475, SEQ ID NO: 1506, SEQ ID NO: 1523, SEQ ID NO: 1556 through SEQ ID NO: 1723, SEQ ID NO: 1752, SEQ ID NO: 1764, SEQ ID NO: 1771, SEQ ID NO: 1774, SEQ ID NO: 1804, SEQ ID NO: 1809 through SEQ ID NO: 1810, SEQ ID NO: 1822, SEQ ID NO: 1830, SEQ ID NO: 1840 through SEQ ID NO: 1845, SEQ ID NO: 1847-1854, SEQ ID NO: 1857 through 1862, SEQ ID NO: 1869, SEQ ID NO: 1878 through SEQ ID NO: 1879, SEQ ID NO: 1881 through SEQ ID NO: 1890, SEQ ID NO: 1892 through SEQ ID NO: 1896, SEQ ID NO: 1898 through SEQ ID NO: 1903, SEQ ID NO: 1905 through SEQ ID NO: 1907, SEQ ID NO: 1909 through SEQ ID NO: 1912, SEQ ID NO: 1932 through SEQ ID NO: 1938, SEQ ID NO: 1950 through SEQ ID NO: 1954, SEQ ID NO: 1959 through SEQ ID NO: 1961, SEQ ID NO: 1971 through SEQ ID NO: 1984, SEQ ID NO: 1990, SEQ ID NO: 1992 through SEQ ID NO: 1993, SEQ ID NO: 1995 through SEQ ID NO: 1998 and SEQ ID NO: 2086 through SEQ ID NO: 2275.

The present invention also provides a substantially purified maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or fragment thereof encoded by a nucleic acid sequence consisting of SEQ ID NO: 46 through SEQ ID NO: 47, SEQ ID NO: 66 through SEQ ID NO: 93, SEQ ID NO: 335, SEQ ID NO: 1475, SEQ ID NO: 1506, SEQ ID NO: 1523,

SEQ ID NO: 1556 through SEQ ID NO: 1723, SEQ ID NO: 1752, SEQ ID NO: 1764, SEQ ID NO: 1771, SEQ ID NO: 1774, SEQ ID NO: 1804, SEQ ID NO: 1809 through SEQ ID NO: 1810, SEQ ID NO: 1822, SEQ ID NO: 1830, SEQ ID NO: 1840 through SEQ ID NO: 1845, SEQ ID NO: 1847 through 1854, SEQ ID NO: 1857 through 1862, SEQ ID NO: 1869, SEQ ID NO: 1878 through SEQ ID NO: 1879, SEQ ID NO: 1881 through SEQ ID NO: 1890, SEQ ID NO: 1892 through SEQ ID NO: 1896, SEQ ID NO: 1898 through SEQ ID NO: 1903, SEQ ID NO: 1905 through SEQ ID NO: 1907, SEQ ID NO: 1909 through SEQ ID NO: 1912, SEQ ID NO: 1932 through SEQ ID NO: 1938, SEQ ID NO: 1950 through SEQ ID NO: 1954, SEQ ID NO: 1959 through SEQ ID NO: 1961, SEQ ID NO: 1971 through SEQ ID NO: 1984, SEQ ID NO: 1990, SEQ ID NO: 1992 through SEQ ID NO: 1993, SEQ ID NO: 1995 through SEQ ID NO: 1998 and SEQ ID NO: 2086 through SEQ ID NO: 2275.

The present invention also provides a substantially purified maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or fragment thereof encoded by a first nucleic acid molecule which specifically hybridizes to a second nucleic acid molecule, the second nucleic acid molecule having a nucleic acid sequence selected from the group consisting of a complement of SEQ ID NO: 94 through SEQ ID NO: 148, SEQ ID NO: 300 through SEQ ID NO: 596, SEQ ID NO: 2118 and SEQ ID NO: 2276 through SEQ ID NO: 2686.

The present invention also provides a substantially purified maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or fragment thereof encoded by a nucleic acid sequence selected from the group consisting of SEQ ID NO: 94 through SEQ ID NO: 148, SEQ ID NO: 300 through SEQ ID NO: 596, SEQ ID NO: 2118 and SEQ ID NO: 2276 through SEQ ID NO: 2686.

The present invention also provides a substantially purified maize, soybean or *Arabidopsis thaliana* other transcription factor or fragment thereof encoded by a first nucleic acid molecule which specifically hybridizes to a second nucleic acid molecule, the second nucleic acid molecule having a nucleic acid sequence selected from the group consisting of a complement of SEQ ID NO: 149 through SEQ ID NO: 299, SEQ ID NO: 597 through SEQ ID NO: 1414 and SEQ ID NO: 2687 through SEQ ID NO: 3853.

The present invention also provides a substantially purified maize, soybean or *Arabidopsis thaliana* other transcription factor or fragment thereof encoded by a nucleic acid sequence selected from the group consisting of SEQ ID NO: 149 through SEQ ID NO: 299, SEQ ID NO: 597 through SEQ ID NO: 1414 and SEQ ID NO: 2687 through SEQ ID NO: 3853.

The present invention also provides a purified antibody or fragment thereof which is capable of specifically binding to a maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof, wherein the maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof is encoded by a nucleic acid molecule comprising a nucleic acid sequence selected from the group consisting of consisting of SEQ ID NO: 1 through SEQ ID NO: 3853.

The present invention also provides a substantially purified antibody or fragment thereof, the antibody or fragment thereof capable of specifically binding to a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or fragment thereof encoded by a first nucleic acid molecule which specifically hybridizes to a second nucleic acid molecule, the second nucleic acid molecule having a nucleic acid sequence selected from the group consisting of a complement of SEQ ID NO: 1 through SEQ ID NO: 49, SEQ ID NO 1415 through SEQ ID NO: 1555 and SEQ ID NO: 1746 through SEQ ID NO: 2000 or a nucleic acid sequence selected

from the group consisting SEQ ID NO: 1 through SEQ ID NO: 49, SEQ ID NO 1415 through SEQ ID NO: 1555 and SEQ ID NO: 1746 through SEQ ID NO: 2000.

The present invention also provides a substantially purified antibody or fragment thereof, the antibody or fragment thereof capable of specifically binding to a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or fragment thereof encoded by a first nucleic acid molecule which specifically hybridizes to a second nucleic acid molecule, the second nucleic acid molecule having a nucleic acid sequence selected from the group consisting of a complement of SEQ ID NO: 50 through SEQ ID NO: 65, SEQ ID NO: 1724 through SEQ ID NO: 1745 and SEQ ID NO: 2001 through SEQ ID NO: 2085 or a nucleic acid sequence selected from the group consisting of SEQ ID NO: 50 through SEQ ID NO: 65, SEQ ID NO: 1724 through SEQ ID NO: 1745 and SEQ ID NO: 2001 through SEQ ID NO: 2085.

The present invention also provides a substantially purified antibody or fragment thereof, the antibody or fragment thereof capable of specifically binding to a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or fragment thereof encoded by a first nucleic acid molecule which specifically hybridizes to a second nucleic acid molecule, the second nucleic acid molecule consisting of a compliment of a nucleic acid sequence having a nucleic acid sequence selected from the group consisting of SEQ ID NO: 46 through SEQ ID NO: 47, SEQ ID NO: 66 through SEQ ID NO: 93, SEQ ID NO: 335, SEQ ID NO: 1475, SEQ ID NO: 1506, SEQ ID NO: 1523, SEQ ID NO: 1556 through SEQ ID NO: 1723, SEQ ID NO: 1752, SEQ ID NO: 1764, SEQ ID NO: 1771, SEQ ID NO: 1774, SEQ ID NO: 1804, SEQ ID NO: 1809 through SEQ ID NO: 1810, SEQ ID NO: 1822, SEQ ID NO: 1830, SEQ ID NO: 1840 through SEQ ID NO: 1845, SEQ ID NO: 1847 through 1854, SEQ ID NO: 1857 through 1862, SEQ ID NO: 1869, SEQ ID NO: 1878 through SEQ ID NO: 1879, SEQ ID NO: 1881 through

second nucleic acid molecule having a nucleic acid sequence selected from the group consisting of a complement of SEQ ID NO: 94 through SEQ ID NO: 148, SEQ ID NO: 300 through SEQ ID NO: 596, SEQ ID NO: 2118 and SEQ ID NO: 2276 through SEQ ID NO: 2686 or a nucleic acid sequence selected from the group consisting SEQ ID NO: 94 through SEQ ID NO: 148, SEQ ID NO: 300 through SEQ ID NO: 596, SEQ ID NO: 2118 and SEQ ID NO: 2276 through SEQ ID NO: 2686.

The present invention also provides a substantially purified antibody or fragment thereof, the antibody or fragment thereof capable of specifically binding to a maize, soybean or *Arabidopsis thaliana* other transcription factor or fragment thereof encoded by a first nucleic acid molecule which specifically hybridizes to a second nucleic acid molecule, the second nucleic acid molecule having a nucleic acid sequence selected from the group consisting of a complement of SEQ ID NO: 149 through SEQ ID NO: 299, SEQ ID NO: 597 through SEQ ID NO: 1414 and SEQ ID NO: 2687 through SEQ ID NO: 3853 or a nucleic acid sequence selected from the group consisting SEQ ID NO: 149 through SEQ ID NO: 299, SEQ ID NO: 597 through SEQ ID NO: 1414 and SEQ ID NO: 2687 through SEQ ID NO: 3853.

The present invention also provides a transformed plant having a nucleic acid molecule which comprises: (A) an exogenous promoter region which functions in a plant cell to cause the production of a mRNA molecule; (B) a structural nucleic acid molecule comprising a nucleic acid sequence selected from the group consisting of (a) a nucleic acid sequence which encodes for a homeobox transcription factor or fragment thereof; (b) a nucleic acid sequence which encodes for a HLH transcription factor or fragment thereof; (c) a nucleic acid sequence which encodes for a leucine zipper transcription factor or fragment thereof; (d) a nucleic acid sequence which encodes for a zinc finger transcription factor or fragment thereof; (e) a nucleic acid

sequence which encodes for an other transcription factor or fragment thereof; (f) a nucleic acid sequence which is complementary to any of the nucleic acid sequences of (a) through (d); and (C) a 3' non-translated sequence that functions in the plant cell to cause termination of transcription and addition of polyadenylated ribonucleotides to a 3' end of the mRNA molecule.

The present invention also provides a transformed plant having a nucleic acid molecule which comprises: (A) an exogenous promoter region which functions in a plant cell to cause the production of a mRNA molecule; which is linked to (B) a structural nucleic acid molecule, wherein the structural nucleic acid molecule encodes a plant transcription factor or fragment thereof, the structural nucleic acid molecule comprising a nucleic acid sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853 or fragment thereof; which is linked to (C) a 3' non-translated sequence that functions in the plant cell to cause termination of transcription and addition of polyadenylated ribonucleotides to a 3' end of the mRNA molecule.

The present invention also provides a transformed plant having a nucleic acid molecule which comprises: (A) an exogenous promoter region which functions in a plant cell to cause the production of a mRNA molecule; which is linked to (B) a structural nucleic acid molecule, wherein the structural nucleic acid molecule is selected from the group consisting of a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or fragment thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or fragment thereof, a nucleic acid molecule that encodes a maize, soybean, or *Arabidopsis thaliana* leucine zipper transcription factor or fragment thereof; a nucleic acid molecule that encodes a maize, soybean, or *Arabidopsis thaliana* zinc finger transcription factor or fragment thereof; and a nucleic acid molecule that encodes a maize, soybean, or *Arabidopsis thaliana* other transcription factors or fragments thereof; which is linked

to (C) a 3' non-translated sequence that functions in the plant cell to cause termination of transcription and addition of polyadenylated ribonucleotides to a 3' end of the mRNA molecule.

The present invention also provides a transformed plant having a nucleic acid molecule which comprises: (A) an exogenous promoter region which functions in a plant cell to cause the production of a mRNA molecule; which is linked to (B) a transcribed nucleic acid molecule with a transcribed strand and a non-transcribed strand, wherein the transcribed strand is complementary to a nucleic acid molecule comprising a nucleic acid sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853 or fragment thereof; which is linked to (C) a 3' non-translated sequence that functions in plant cells to cause termination of transcription and addition of polyadenylated ribonucleotides to a 3' end of the mRNA molecule.

The present invention also provides a transformed plant having a nucleic acid molecule which comprises: (A) an exogenous promoter region which functions in a plant cell to cause the production of a mRNA molecule; which is linked to: (B) a transcribed nucleic acid molecule with a transcribed strand and a non-transcribed strand, wherein a transcribed mRNA of the transcribed strand is complementary to an endogenous mRNA molecule having a nucleic acid sequence selected from the group consisting of an endogenous mRNA molecule that encodes a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or fragment thereof, an endogenous mRNA molecule that encodes a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or fragment thereof, an endogenous mRNA molecule that encodes a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or fragment thereof; an endogenous mRNA molecule that encodes a maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or fragment thereof and an endogenous mRNA molecule that encodes a maize, soybean or *Arabidopsis thaliana* other transcription factor or fragment thereof; which is

linked to (C) a 3' non-translated sequence that functions in the plant cell to cause termination of transcription and addition of polyadenylated ribonucleotides to a 3' end of the mRNA molecule.

The present invention also provides a method for determining a level or pattern of a plant transcription factor in a plant cell or plant tissue comprising: (A) incubating, under conditions permitting nucleic acid hybridization, a marker nucleic acid molecule, the marker nucleic acid molecule having a nucleic acid sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof or fragment of either, with a complementary nucleic acid molecule obtained from the plant cell or plant tissue, wherein nucleic acid hybridization between the marker nucleic acid molecule and the complementary nucleic acid molecule obtained from the plant cell or plant tissue permits the detection of the plant transcription factor; (B) permitting hybridization between the marker nucleic acid molecule and the complementary nucleic acid molecule obtained from the plant cell or plant tissue; and (C) detecting the level or pattern of the complementary nucleic acid, wherein the detection of the complementary nucleic acid is predictive of the level or pattern of the plant transcription factor.

The present invention also provides a method for determining a level or pattern of a plant transcription factor in a plant cell or plant tissue comprising: (A) incubating, under conditions permitting nucleic acid hybridization, a marker nucleic acid molecule, the marker nucleic acid molecule comprising a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or complement thereof or fragment of either, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or complement thereof or fragment of either, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or complement thereof or fragment of either, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* zinc finger

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transcription factor or complement thereof or fragment of either and a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* other transcription factor or complement thereof or fragment of either, with a complementary nucleic acid molecule obtained from the plant cell or plant tissue, wherein nucleic acid hybridization between the marker nucleic acid molecule and the complementary nucleic acid molecule obtained from the plant cell or plant tissue permits the detection of the plant transcription factor; (B) permitting hybridization between the marker nucleic acid molecule and the complementary nucleic acid molecule obtained from the plant cell or plant tissue; and (C) detecting the level or pattern of the complementary nucleic acid, wherein the detection of the complementary nucleic acid is predictive of the level or pattern of the plant transcription factor.

The present invention also provides a method for determining a level or pattern of a plant transcription factor in a plant cell or plant tissue under evaluation which comprises assaying the concentration of a molecule, whose concentration is dependent upon the expression of a gene, the gene specifically hybridizes to a nucleic acid molecule having a nucleic acid sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof, in comparison to the concentration of that molecule present in a reference plant cell or a reference plant tissue with a known level or pattern of the plant transcription factor, wherein the assayed concentration of the molecule is compared to the assayed concentration of the molecule in the reference plant cell or reference plant tissue with the known level or pattern of the plant transcription factor.

The present invention also provides a method for determining a level or pattern of a plant transcription factor in a plant cell or plant tissue under evaluation which comprises assaying the concentration of a molecule, whose concentration is dependent upon the expression of a gene, the

gene specifically hybridizes to a nucleic acid molecule selected from the group consisting of a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or complement thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or complement thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or complement thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or complement thereof and a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* other transcription factor or complement thereof, in comparison to the concentration of that molecule present in a reference plant cell or a reference plant tissue with a known level or pattern of the plant transcription factor, wherein the assayed concentration of the molecule is compared to the assayed concentration of the molecule in the reference plant cell or the reference plant tissue with the known level or pattern of the plant transcription factor.

The present invention provides a method of determining a mutation in a plant whose presence is predictive of a mutation affecting a level or pattern of a protein comprising the steps: (A) incubating, under conditions permitting nucleic acid hybridization, a marker nucleic acid, the marker nucleic acid selected from the group of marker nucleic acid molecules which specifically hybridize to a nucleic acid molecule having a nucleic acid sequence selected from the group of SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof or fragment of either and a complementary nucleic acid molecule obtained from the plant, wherein nucleic acid hybridization between the marker nucleic acid molecule and the complementary nucleic acid molecule obtained from the plant permits the detection of a polymorphism whose presence is predictive of a mutation affecting the level or pattern of the protein in the plant; (B) permitting

hybridization between the marker nucleic acid molecule and the complementary nucleic acid molecule obtained from the plant; and (C) detecting the presence of the polymorphism, wherein the detection of the polymorphism is predictive of the mutation.

The present invention also provides a method for determining a mutation in a plant whose presence is predictive of a mutation affecting the level or pattern of a plant transcription factor comprising the steps: (A) incubating, under conditions permitting nucleic acid hybridization, a marker nucleic acid molecule, the marker nucleic acid molecule comprising a nucleic acid molecule that is linked to a gene, the gene specifically hybridizes to a nucleic acid molecule having a nucleic acid sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof and a complementary nucleic acid molecule obtained from the plant, wherein nucleic acid hybridization between the marker nucleic acid molecule and the complementary nucleic acid molecule obtained from the plant permits the detection of a polymorphism whose presence is predictive of a mutation affecting the level or pattern of the plant transcription factor in the plant; (B) permitting hybridization between the marker nucleic acid molecule and the complementary nucleic acid molecule obtained from the plant; and (C) detecting the presence of the polymorphism, wherein the detection of the polymorphism is predictive of the mutation.

The present invention also provides a method for determining a mutation in a plant whose presence is predictive of a mutation affecting the level or pattern of a plant transcription factor comprising the steps: (A) incubating, under conditions permitting nucleic acid hybridization, a marker nucleic acid molecule, the marker nucleic acid molecule comprising a nucleic acid molecule that is linked to a gene, the gene specifically hybridizes to a nucleic acid molecule selected from the group consisting of a nucleic acid molecule that encodes a maize, soybean or

Arabidopsis thaliana homeobox transcription factor or complement thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or complement thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or complement thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or complement thereof and a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* other transcription factor or complement thereof and a complementary nucleic acid molecule obtained from the plant, wherein nucleic acid hybridization between the marker nucleic acid molecule and the complementary nucleic acid molecule obtained from the plant permits the detection of a polymorphism whose presence is predictive of a mutation affecting the level or pattern of the plant transcription factor in the plant; (B) permitting hybridization between the marker nucleic acid molecule and the complementary nucleic acid molecule obtained from the plant; and (C) detecting the presence of the polymorphism, wherein the detection of the polymorphism is predictive of the mutation.

The present invention also provides a method of producing a plant containing an overexpressed protein comprising: (A) transforming the plant with a functional nucleic acid molecule, wherein the functional nucleic acid molecule comprises a promoter region, wherein the promoter region is linked to a structural region, wherein the structural region has a nucleic acid sequence selected from group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853 wherein the structural region is linked to a 3' non-translated sequence that functions in the plant to cause termination of transcription and addition of polyadenylated ribonucleotides to a 3' end of a mRNA molecule; and wherein the functional nucleic acid molecule results in overexpression of the protein; and (B) growing the transformed plant.

transcription and addition of polyadenylated ribonucleotides to a 3' end of a mRNA molecule; and wherein the functional nucleic acid molecule results in overexpression of the plant transcription factor; and (B) growing the transformed plant.

The present invention also provides a method of producing a plant containing reduced levels of a plant transcription factor comprising: (A) transforming the plant with a functional nucleic acid molecule, wherein the functional nucleic acid molecule comprises a promoter region, wherein the promoter region is linked to a structural region, wherein the structural region comprises a nucleic acid molecule having a nucleic acid sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853; wherein the structural region is linked to a 3' non-translated sequence that functions in the plant to cause termination of transcription and addition of polyadenylated ribonucleotides to a 3' end of a mRNA molecule; and wherein the functional nucleic acid molecule results in co-suppression of the plant transcription factor; and (B) growing the transformed plant.

The present invention also provides a method of producing a plant containing reduced levels of a plant transcription factor comprising: (A) transforming the plant with a functional nucleic acid molecule, wherein the functional nucleic acid molecule comprises a promoter region, wherein the promoter region is linked to a structural region, wherein the structural region comprises a nucleic acid molecule having a nucleic acid sequence selected from the group consisting of a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or fragment thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or fragment thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or fragment thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis*

thaliana leucine zinc finger transcription factor or fragment thereof and a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* other transcription factor or fragment thereof, wherein the structural region is linked to a 3' non-translated sequence that functions in the plant to cause termination of transcription and addition of polyadenylated ribonucleotides to a 3' end of a mRNA molecule; and wherein the functional nucleic acid molecule results in co-suppression of the plant transcription factor; and (B) growing the transformed plant.

The present invention also provides a method for reducing expression of a plant transcription factor in a plant comprising: (A) transforming the plant with a nucleic acid molecule, the nucleic acid molecule having an exogenous promoter region which functions in a plant cell to cause the production of a mRNA molecule, wherein the exogenous promoter region is linked to a transcribed nucleic acid molecule having a transcribed strand and a non-transcribed strand, wherein the transcribed strand is complementary to a nucleic acid molecule having a nucleic acid sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof or fragments of either and the transcribed strand is complementary to an endogenous mRNA molecule; and wherein the transcribed nucleic acid molecule is linked to a 3' non-translated sequence that functions in the plant cell to cause termination of transcription and addition of polyadenylated ribonucleotides to a 3' end of a mRNA molecule; and (B) growing the transformed plant.

The present invention also provides a method for reducing expression of a plant transcription factor in a plant comprising: (A) transforming the plant with a nucleic acid molecule, the nucleic acid molecule having an exogenous promoter region which functions in a plant cell to cause the production of a mRNA molecule, wherein the exogenous promoter region is linked to a transcribed nucleic acid molecule having a transcribed strand and a non-transcribed

strand, wherein a transcribed mRNA of the transcribed strand is complementary to a nucleic acid molecule selected from the group consisting of an endogenous mRNA molecule that encodes a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or fragment thereof, an endogenous mRNA molecule that encodes a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or fragment thereof, an endogenous mRNA molecule that encodes a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or fragment thereof, an endogenous mRNA molecule that encodes a maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or fragment thereof and an endogenous mRNA molecule that encodes a maize, soybean or *Arabidopsis thaliana* other transcription factor or fragment thereof, and wherein the transcribed nucleic acid molecule is linked to a 3' non-translated sequence that functions in the plant cell to cause termination of transcription and addition of polyadenylated ribonucleotides to a 3' end of a mRNA molecule; and (B) growing the transformed plant.

The present invention also provides a method of determining an association between a polymorphism and a plant trait comprising: (A) hybridizing a nucleic acid molecule specific for the polymorphism to genetic material of a plant, wherein the nucleic acid molecule has a nucleic acid sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof or fragment of either; and (B) calculating the degree of association between the polymorphism and the plant trait.

The present invention also provides a method of determining an association between a polymorphism and a plant trait comprising: (A) hybridizing a nucleic acid molecule specific for the polymorphism to genetic material of a plant, wherein the nucleic acid molecule is selected from the group consisting of a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or complement thereof or fragment of either,

a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or complement thereof or fragment of either, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or complement thereof or fragment of either, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or complement thereof or fragment of either and a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* other transcription factor or complement thereof or fragment of either and (B) calculating the degree of association between the polymorphism and the plant trait.

The present invention also provides a method of isolating a nucleic acid that encodes a plant transcription factor or fragment thereof comprising: (A) incubating under conditions permitting nucleic acid hybridization, a first nucleic acid molecule comprising a nucleic acid sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof or fragment of either with a complementary second nucleic acid molecule obtained from a plant cell or plant tissue; (B) permitting hybridization between the first nucleic acid molecule and the second nucleic acid molecule obtained from the plant cell or plant tissue; and (C) isolating the second nucleic acid molecule.

The present invention also provides a method of isolating a nucleic acid molecule that encodes a plant transcription factor or fragment thereof comprising: (A) incubating under conditions permitting nucleic acid hybridization, a first nucleic acid molecule selected from the group consisting of a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or complement thereof or fragment of either, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or complement thereof or fragment of either, a nucleic acid molecule that encodes a maize, soybean

or *Arabidopsis thaliana* leucine zipper transcription factor or complement thereof or fragment of either, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or complement thereof or fragment of either and a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* other transcription factor or complement thereof or fragment of either, with a complementary second nucleic acid molecule obtained from a plant cell or plant tissue; (B) permitting hybridization between the plant transcription factor nucleic acid molecule and the complementary nucleic acid molecule obtained from the plant cell or plant tissue; and (C) isolating the second nucleic acid molecule.

DETAILED DESCRIPTION OF THE INVENTION

Agents of the Present Invention

Agents

(a) Nucleic Acid Molecules

Agents of the present invention include plant nucleic acid molecules and more preferably include maize, soybean and *Arabidopsis thaliana* nucleic acid molecules and more preferably include nucleic acid molecules of the maize genotypes B73 (Illinois Foundation Seeds, Champaign, Illinois U.S.A.), B73 x Mo17 (Illinois Foundation Seeds, Champaign, Illinois U.S.A.), DK604 (Dekalb Genetics, Dekalb, Illinois U.S.A.), H99 (Illinois Foundation Seeds, Champaign, Illinois U.S.A.), RX601 (Asgrow Seed Company, Des Moines, Iowa), Mo17 (Illinois Foundation Seeds, Champaign, Illinois U.S.A.), and soybean types Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa), C1944 (United States Department of Agriculture (USDA) Soybean Germplasm Collection, Urbana, Illinois U.S.A.), Cristalina (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.), FT108 (Monsoy, Brazil), Hartwig (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.), BW211S Null (Tohoku University,

Morioka, Japan), PI507354 (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.), Asgrow A4922 (Asgrow Seed Company, Des Moines, Iowa U.S.A.), PI227687 (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.), PI229358 (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.) and Asgrow A3237 (Asgrow Seed Company, Des Moines, Iowa U.S.A.).

A subset of the nucleic acid molecules of the present invention includes nucleic acid molecules that are marker molecules. Another subset of the nucleic acid molecules of the present invention include nucleic acid molecules that encode a protein or fragment thereof. Another subset of the nucleic acid molecules of the present invention are EST molecules.

Fragment nucleic acid molecules may encode significant portion(s) of, or indeed most of, these nucleic acid molecules. Alternatively, the fragments may comprise smaller oligonucleotides (having from about 15 to about 250 nucleotide residues and more preferably, about 15 to about 30 nucleotide residues).

As used herein, an agent, be it a naturally occurring molecule or otherwise may be “substantially purified,” if desired, such that one or more molecules that is or may be present in a naturally occurring preparation containing that molecule will have been removed or will be present at a lower concentration than that at which it would normally be found.

The agents of the present invention will preferably be “biologically active” with respect to either a structural attribute, such as the capacity of a nucleic acid to hybridize to another nucleic acid molecule, or the ability of a protein to be bound by an antibody (or to compete with another molecule for such binding). Alternatively, such an attribute may be catalytic and thus involve the capacity of the agent to mediate a chemical reaction or response.

The agents of the present invention may also be recombinant. As used herein, the term recombinant means any agent (e.g. DNA, peptide etc.), that is, or results, however indirect, from human manipulation of a nucleic acid molecule.

It is understood that the agents of the present invention may be labeled with reagents that facilitate detection of the agent (e.g. fluorescent labels, Prober *et al.*, *Science* 238:336-340 (1987); Albarella *et al.*, EP 144914; chemical labels, Sheldon *et al.*, U.S. Patent 4,582,789; Albarella *et al.*, U.S. Patent 4,563,417; modified bases, Miyoshi *et al.*, EP 119448, all of which are hereby incorporated by reference in their entirety).

It is further understood, that the present invention provides recombinant bacterial, mammalian, microbial, insect, fungal and plant cells and viral constructs comprising the agents of the present invention. (See, for example, Uses of the Agents of the Invention, Section (a) Plant Constructs and Plant Transformants; Section (b) Fungal Constructs and Fungal Transformants; Section (c) Mammalian Constructs and Transformed Mammalian Cells; Section (d) Insect Constructs and Transformed Insect Cells; and Section (e) Bacterial Constructs and Transformed Bacterial Cells)

Nucleic acid molecules or fragments thereof of the present invention are capable of specifically hybridizing to other nucleic acid molecules under certain circumstances. As used herein, two nucleic acid molecules are said to be capable of specifically hybridizing to one another if the two molecules are capable of forming an anti-parallel, double-stranded nucleic acid structure. A nucleic acid molecule is said to be the "complement" of another nucleic acid molecule if they exhibit complete complementarity. As used herein, molecules are said to exhibit "complete complementarity" when every nucleotide of one of the molecules is complementary to a nucleotide of the other. Two molecules are said to be "minimally

complementary" if they can hybridize to one another with sufficient stability to permit them to remain annealed to one another under at least conventional "low-stringency" conditions. Similarly, the molecules are said to be "complementary" if they can hybridize to one another with sufficient stability to permit them to remain annealed to one another under conventional "high-stringency" conditions. Conventional stringency conditions are described by Sambrook *et al.*, *Molecular Cloning, A Laboratory Manual*, 2nd Ed., Cold Spring Harbor Press, Cold Spring Harbor, New York (1989) and by Haymes *et al.*, *Nucleic Acid Hybridization, A Practical Approach*, IRL Press, Washington, DC (1985), the entirety of which is herein incorporated by reference. Departures from complete complementarity are therefore permissible, as long as such departures do not completely preclude the capacity of the molecules to form a double-stranded structure. Thus, in order for a nucleic acid molecule to serve as a primer or probe it need only be sufficiently complementary in sequence to be able to form a stable double-stranded structure under the particular solvent and salt concentrations employed.

Appropriate stringency conditions which promote DNA hybridization, for example, 6.0 X sodium chloride/sodium citrate (SSC) at about 45°C, followed by a wash of 2.0 X SSC at 50°C, are known to those skilled in the art or can be found in *Current Protocols in Molecular Biology*, John Wiley & Sons, N.Y. (1989), 6.3.1-6.3.6. For example, the salt concentration in the wash step can be selected from a low stringency of about 2.0 X SSC at 50°C to a high stringency of about 0.2 X SSC at 50°C. In addition, the temperature in the wash step can be increased from low stringency conditions at room temperature, about 22°C, to high stringency conditions at about 65°C. Both temperature and salt may be varied, or either the temperature or the salt concentration may be held constant while the other variable is changed.

In a preferred embodiment, a nucleic acid of the present invention will specifically hybridize to one or more of the nucleic acid molecules set forth in SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof under moderately stringent conditions, for example at about 2.0 X SSC and about 65°C.

In a particularly preferred embodiment, a nucleic acid of the present invention will include those nucleic acid molecules that specifically hybridize to one or more of the nucleic acid molecules set forth in SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof under high stringency conditions such as 0.2 X SSC and about 65°C.

In one aspect of the present invention, the nucleic acid molecules of the present invention have one or more of the nucleic acid sequences set forth in SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof. In another aspect of the present invention, one or more of the nucleic acid molecules of the present invention share between 100% and 90% sequence identity with one or more of the nucleic acid sequences set forth in SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof. In a further aspect of the present invention, one or more of the nucleic acid molecules of the present invention share between 100% and 95% sequence identity with one or more of the nucleic acid sequences set forth in SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof. In a more preferred aspect of the present invention, one or more of the nucleic acid molecules of the present invention share between 100% and 98% sequence identity with one or more of the nucleic acid sequences set forth in SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof. In an even more preferred aspect of the present invention, one or more of the nucleic acid molecules of the present invention share between 100% and 99% sequence identity with one or more of the sequences set forth in SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof.

In a further more preferred aspect of the present invention, one or more of the nucleic acid molecules of the present invention exhibit 100% sequence identity with a nucleic acid molecule present within MONN01, SATMON001, SATMON003 through SATMON014, SATMON016 through SATMON031, SATMON033, SATMON034, SATMON~001, SATMONN01, SATMONN04 through SATMONN006, CMz029 through CMz031, CMz033 through CMz037, CMz039 through CMz042, CMz044 through CMz045, CMz047 through CMz050, SOYMON001 through SOYMON038, Soy51 through Soy56, Soy58 through Soy62, Soy65 through Soy73 and Soy76 through Soy77, Lib9, Lib22 through Lib25, Lib35, and Lib146 (Monsanto Company, St. Louis, Missouri U.S.A.).

(i) Nucleic Acid Molecules Encoding Proteins or Fragments Thereof

Nucleic acid molecules of the present invention can comprise sequences that encode a transcription factor or fragment thereof. Such transcription factors or fragments thereof include homologues of known transcription factors in other organisms.

In a preferred embodiment of the present invention, a maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof of the present invention is a homologue of another plant transcription factor. In another preferred embodiment of the present invention, a maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof of the present invention is a homologue of a fungal transcription factor. In another preferred embodiment of the present invention, a maize, soybean or *Arabidopsis thaliana* transcription factor of the present invention is a homologue of mammalian transcription factor. In another preferred embodiment of the present invention, a maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof of the present invention is a homologue of a bacterial transcription factor. In another preferred embodiment of the present invention, a maize, soybean or

Arabidopsis thaliana transcription factor or fragment thereof of the present invention is a homologue of a maize transcription factor. In another preferred embodiment of the present invention, a maize, soybean or *Arabidopsis thaliana* transcription factor homologue or fragment thereof of the present invention is a homologue of a soybean transcription factor. In another preferred embodiment of the present invention, a maize, soybean or *Arabidopsis thaliana* transcription factor homologue or fragment thereof of the present invention is a homologue of an *Arabidopsis thaliana* transcription factor.

In a preferred embodiment of the present invention, the nucleic molecule of the present invention encodes a maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof where a maize, soybean or *Arabidopsis thaliana* transcription factor exhibits a BLAST probability score of greater than 1E-12, preferably a BLAST probability score of between about 1E-30 and about 1E-12, even more preferably a BLAST probability score of greater than 1E-30 with its homologue.

In another preferred embodiment of the present invention, the nucleic acid molecule encoding a maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof exhibits a % identity with its homologue of between about 25% and about 40%, more preferably of between about 40 and about 70%, even more preferably of between about 70% and about 90% and even more preferably between about 90% and 99%. In another preferred embodiment, of the present invention, a maize, soybean or *Arabidopsis thaliana* transcription factor or fragments thereof exhibits a % identity with its homologue of 100%.

In a preferred embodiment of the present invention, the nucleic molecule of the present invention encodes a maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof where a maize, soybean or *Arabidopsis thaliana* transcription factor exhibits a BLAST

score of greater than 120, preferably a BLAST score of between about 1450 and about 120, even more preferably a BLAST score of greater than 1450 with its homologue.

Nucleic acid molecules of the present invention also include non-maize, non-soybean homologues. Preferred non- homologues are selected from the group consisting of alfalfa, *Arabidopsis*, barley, *Brassica*, broccoli, cabbage, citrus, cotton, garlic, oat, oilseed rape, onion, canola, flax, an ornamental plant, pea, peanut, pepper, potato, rice, rye, sorghum, strawberry, sugarcane, sugarbeet, tomato, wheat, poplar, pine, fir, eucalyptus, apple, lettuce, lentils, grape, banana, tea, turf grasses, sunflower, oil palm and *Phaseolus*.

In a preferred embodiment, nucleic acid molecules having SEQ ID NO: 1 through SEQ ID NO: 3853 or complements and fragments of either can be utilized to obtain such homologues.

The degeneracy of the genetic code, which allows different nucleic acid sequences to code for the same protein or peptide, is known in the literature. (U.S. Patent No. 4,757,006, the entirety of which is herein incorporated by reference).

In an aspect of the present invention, one or more of the nucleic acid molecules of the present invention differ in nucleic acid sequence from those encoding a maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof in SEQ ID NO: 1 through SEQ ID NO: 3853 due to the degeneracy in the genetic code in that they encode the same transcription factor but differ in nucleic acid sequence.

In another further aspect of the present invention, one or more of the nucleic acid molecules of the present invention differ in nucleic acid sequence from those encoding a maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof in SEQ ID NO: 1 through SEQ ID NO: 3853 due to fact that the different nucleic acid sequence encodes a transcription factor having one or more conservative amino acid residue. Examples of

conservative substitutions are set forth in Table 1. It is understood that codons capable of coding for such conservative substitutions are known in the art.

Table 1

<u>Original Residue</u>	<u>Conservative Substitutions</u>
Ala	Ser
Arg	Lys
Asn	Gln; His
Asp	Glu
Cys	Ser; Ala
Gln	Asn
Glu	Asp
Gly	Pro
His	Asn; Gln
Ile	Leu; Val
Leu	Ile; Val
Lys	Arg; Gln; Glu
Met	Leu; Ile
Phe	Met; Leu; Tyr
Ser	Thr
Thr	Ser
Trp	Tyr
Tyr	Trp; Phe

Val

Ile; Leu

In a further aspect of the present invention, one or more of the nucleic acid molecules of the present invention differ in nucleic acid sequence from those encoding a maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof set forth in SEQ ID NO: 1 through SEQ ID NO: 3853 or fragment thereof due to the fact that one or more codons encoding an amino acid has been substituted for a codon that encodes a nonessential substitution of the amino acid originally encoded.

Agents of the present invention include nucleic acid molecules that encode a maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof and particularly substantially purified nucleic acid molecules selected from the group consisting of a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or fragment thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or fragment thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or fragment thereof, , a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or fragment thereof and , a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* other transcription factor or fragment thereof.

Non-limiting examples of such nucleic acid molecules of the present invention are nucleic acid molecules comprising: SEQ ID NO: 1 through SEQ ID NO: 3853 or fragment thereof that encode for a plant transcription factor or fragment thereof, SEQ ID NO: 1 through SEQ ID NO: 49, SEQ ID NO 1415 through SEQ ID NO: 1555 and SEQ ID NO: 1746 through SEQ ID NO: 2000 or fragment thereof that encode for a homeobox transcription factor or

A nucleic acid molecule of the present invention can also encode an homologue of a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or fragment thereof, a maize, soybean or *Arabidopsis thaliana* HLH transcription factor, a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor, a maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor, or fragment thereof or a maize, soybean or *Arabidopsis thaliana* other transcription factor or fragment thereof. As used herein a homologue protein molecule or fragment thereof is a counterpart protein molecule or fragment thereof in a second species (e.g., maize homeobox transcription factor is a homologue of *Arabidopsis*' homeobox transcription factor).

(ii) Nucleic Acid Molecule Markers and Probes

One aspect of the present invention concerns markers that include nucleic acid molecules SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof or fragments of either that can act as markers or other nucleic acid molecules of the present invention that can act as markers. Genetic markers of the present invention include "dominant" or "codominant" markers "Codominant markers" reveal the presence of two or more alleles (two per diploid individual) at a locus. "Dominant markers" reveal the presence of only a single allele per locus. The presence of the dominant marker phenotype (e.g., a band of DNA) is an indication that one allele is present in either the homozygous or heterozygous condition. The absence of the dominant marker phenotype (e.g. absence of a DNA band) is merely evidence that "some other" undefined allele is present. In the case of populations where individuals are predominantly homozygous and loci are predominately dimorphic, dominant and codominant markers can be equally valuable. As populations become more heterozygous and multi-allelic, codominant markers often become more informative of the genotype than dominant markers. Marker molecules can

be, for example, capable of detecting polymorphisms such as single nucleotide polymorphisms (SNPs).

SNPs are single base changes in genomic DNA sequence. They occur at greater frequency and are spaced with a greater uniformity throughout a genome than other reported forms of polymorphism. The greater frequency and uniformity of SNPs means that there is greater probability that such a polymorphism will be found near or in a genetic locus of interest than would be the case for other polymorphisms. SNPs are located in protein-coding regions and noncoding regions of a genome. Some of these SNPs may result in defective or variant protein expression (e.g., as a results of mutations or defective splicing). Analysis (genotyping) of characterized SNPs can require only a plus/minus assay rather than a lengthy measurement, permitting easier automation.

SNPs can be characterized using any of a variety of methods. Such methods include the direct or indirect sequencing of the site, the use of restriction enzymes (Botstein *et al.*, *Am. J. Hum. Genet.* 32:314-331 (1980), the entirety of which is herein incorporated reference; Konieczny and Ausubel, *Plant J.* 4:403-410 (1993), the entirety of which is herein incorporated by reference), enzymatic and chemical mismatch assays (Myers *et al.*, *Nature* 313:495-498 (1985), the entirety of which is herein incorporated by reference), allele-specific PCR (Newton *et al.*, *Nucl. Acids Res.* 17:2503-2516 (1989), the entirety of which is herein incorporated by reference; Wu *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 86:2757-2760 (1989), the entirety of which is herein incorporated by reference), ligase chain reaction (Barany, *Proc. Natl. Acad. Sci. (U.S.A.)* 88:189-193 (1991), the entirety of which is herein incorporated by reference), single-strand conformation polymorphism analysis (Labrune *et al.*, *Am. J. Hum. Genet.* 48: 1115-1120 (1991), the entirety of which is herein incorporated by reference), primer-directed nucleotide

incorporation assays (Kuppuswami *et al.*, *Proc. Natl. Acad. Sci. USA* 88:1143-1147 (1991), the entirety of which is herein incorporated by reference), dideoxy fingerprinting (Sarkar *et al.*, *Genomics* 13:441-443 (1992), the entirety of which is herein incorporated by reference), solid-phase ELISA-based oligonucleotide ligation assays (Nikiforov *et al.*, *Nucl. Acids Res.* 22:4167-4175 (1994), the entirety of which is herein incorporated by reference), oligonucleotide fluorescence-quenching assays (Livak *et al.*, *PCR Methods Appl.* 4:357-362 (1995), the entirety of which is herein incorporated by reference), 5'-nuclease allele-specific hybridization TaqMan assay (Livak *et al.*, *Nature Genet.* 9:341-342 (1995), the entirety of which is herein incorporated by reference), template-directed dye-terminator incorporation (TDI) assay (Chen and Kwok, *Nucl. Acids Res.* 25:347-353 (1997), the entirety of which is herein incorporated by reference), allele-specific molecular beacon assay (Tyagi *et al.*, *Nature Biotech.* 16: 49-53 (1998), the entirety of which is herein incorporated by reference), PinPoint assay (Haff and Smirnov, *Genome Res.* 7: 378-388 (1997), the entirety of which is herein incorporated by reference) and dCAPS analysis (Neff *et al.*, *Plant J.* 14:387-392 (1998), the entirety of which is herein incorporated by reference).

Additional markers, such as AFLP markers, RFLP markers and RAPD markers, can be utilized (Walton, *Seed World* 22-29 (July, 1993), the entirety of which is herein incorporated by reference; Burow and Blake, *Molecular Dissection of Complex Traits*, 13-29, Paterson (ed.), CRC Press, New York (1988), the entirety of which is herein incorporated by reference). DNA markers can be developed from nucleic acid molecules using restriction endonucleases, the PCR and/or DNA sequence information. RFLP markers result from single base changes or insertions/deletions. These codominant markers are highly abundant in plant genomes, have a medium level of polymorphism and are developed by a combination of restriction endonuclease

digestion and Southern blotting hybridization. CAPS are similarly developed from restriction nuclease digestion but only of specific PCR products. These markers are also codominant, have a medium level of polymorphism and are highly abundant in the genome. The CAPS result from single base changes and insertions/deletions.

Another marker type, RAPDs, are developed from DNA amplification with random primers and result from single base changes and insertions/deletions in plant genomes. They are dominant markers with a medium level of polymorphisms and are highly abundant. AFLP markers require using the PCR on a subset of restriction fragments from extended adapter primers. These markers are both dominant and codominant are highly abundant in genomes and exhibit a medium level of polymorphism.

SSRs require DNA sequence information. These codominant markers result from repeat length changes, are highly polymorphic and do not exhibit as high a degree of abundance in the genome as CAPS, AFLPs and RAPDs SNPs also require DNA sequence information. These codominant markers result from single base substitutions. They are highly abundant and exhibit a medium of polymorphism (Rafalski *et al.*, In: *Nonmammalian Genomic Analysis*, Birren and Lai (ed.), Academic Press, San Diego, CA, pp. 75-134 (1996), the entirety of which is herein incorporated by reference). It is understood that a nucleic acid molecule of the present invention may be used as a marker.

A PCR probe is a nucleic acid molecule capable of initiating a polymerase activity while in a double-stranded structure to with another nucleic acid. Various methods for determining the structure of PCR probes and PCR techniques exist in the art. Computer generated searches using programs such as Primer3 (www-genome.wi.mit.edu/cgi-bin/primer/primer3.cgi), STSPipeline (www-genome.wi.mit.edu/cgi-bin/www-STSPipeline), or GeneUp (Pesole *et al.*,

BioTechniques 25:112-122 (1998) the entirety of which is herein incorporated by reference), for example, can be used to identify potential PCR primers.

It is understood that a fragment of one or more of the nucleic acid molecules of the present invention may be a probe and specifically a PCR probe.

(b) Protein and Peptide Molecules

A class of agents comprises one or more of the protein or fragments thereof or peptide molecules encoded by SEQ ID NO: 1 through SEQ ID NO: 3853 or one or more of the protein or fragment thereof and peptide molecules encoded by other nucleic acid agents of the present invention. As used herein, the term "protein molecule" or "peptide molecule" includes any molecule that comprises five or more amino acids. It is well known in the art that proteins may undergo modification, including post-translational modifications, such as, but not limited to, disulfide bond formation, glycosylation, phosphorylation, or oligomerization. Thus, as used herein, the term "protein molecule" or "peptide molecule" includes any protein molecule that is modified by any biological or non-biological process. The terms "amino acid" and "amino acids" refer to all naturally occurring L-amino acids. This definition is meant to include norleucine, ornithine, homocysteine and homoserine.

Non-limiting examples of the protein or fragment thereof of the present invention include a maize, soybean or *Arabidopsis thaliana* transcription factor or fragment thereof; a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or fragment thereof, a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or fragment thereof, a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or fragment thereof, a maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or fragment thereof, or a maize, soybean or *Arabidopsis thaliana* other transcription factor or fragment thereof,



Non-limiting examples of the protein or fragment molecules of the present invention are a transcription factor or fragment thereof encoded by: SEQ ID NO: 1 through SEQ ID NO: 3853 or fragment thereof that encode for a transcription factor or fragment thereof, SEQ ID NO: 1 through SEQ ID NO: 49, SEQ ID NO 1415 through SEQ ID NO: 1555 and SEQ ID NO: 1746 through SEQ ID NO: 2000 or fragment thereof that encode for a homeobox transcription factor or fragment thereof, SEQ ID NO: 50 through SEQ ID NO: 65, SEQ ID NO: 1724 through SEQ ID NO: 1745 and SEQ ID NO: 2001 through SEQ ID NO: 2085 or fragment thereof that encode for a HLH transcription factor or fragment thereof, SEQ ID NO: 46 through SEQ ID NO: 47, SEQ ID NO: 66 through SEQ ID NO: 93, SEQ ID NO: 335, SEQ ID NO: 1475, SEQ ID NO: 1506, SEQ ID NO: 1523, SEQ ID NO: 1556 through SEQ ID NO: 1723, SEQ ID NO: 1752, SEQ ID NO: 1764, SEQ ID NO: 1771, SEQ ID NO: 1774, SEQ ID NO: 1804, SEQ ID NO: 1809 through SEQ ID NO: 1810, SEQ ID NO: 1822, SEQ ID NO: 1830, SEQ ID NO: 1840 through SEQ ID NO: 1845, SEQ ID NO: 1847 through 1854, SEQ ID NO: 1857 through 1862, SEQ ID NO: 1869, SEQ ID NO: 1878 through SEQ ID NO: 1879, SEQ ID NO: 1881 through SEQ ID NO: 1890, SEQ ID NO: 1892 through SEQ ID NO: 1896, SEQ ID NO: 1898 through SEQ ID NO: 1903, SEQ ID NO: 1905 through SEQ ID NO: 1907, SEQ ID NO: 1909 through SEQ ID NO: 1912, SEQ ID NO: 1932 through SEQ ID NO: 1938, SEQ ID NO: 1950 through SEQ ID NO: 1954, SEQ ID NO: 1959 through SEQ ID NO: 1961, SEQ ID NO: 1971 through SEQ ID NO: 1984, SEQ ID NO: 1990, SEQ ID NO: 1992 through SEQ ID NO: 1993, SEQ ID NO: 1995 through SEQ ID NO: 1998 and SEQ ID NO: 2086 through SEQ ID NO: 2275 or fragment thereof that encode for a leucine zipper transcription factor or fragment thereof, SEQ ID NO: 94 through SEQ ID NO: 148, SEQ ID NO: 300 through

SEQ ID NO: 596, SEQ ID NO: 2118 and SEQ ID NO: 2276 through SEQ ID NO: 2686 or fragment thereof that encode for a zinc finger transcription factor or fragment thereof, and SEQ ID NO: 149 through SEQ ID NO: 299, SEQ ID NO: 597 through SEQ ID NO: 1414 and SEQ ID NO: 2687 through SEQ ID NO: 3853 or fragment thereof that encode for an other transcription factor or fragment thereof.

One or more of the protein or fragment of peptide molecules may be produced via chemical synthesis, or more preferably, by expressing in a suitable bacterial or eucaryotic host. Suitable methods for expression are described by Sambrook *et al.*, (In: *Molecular Cloning, A Laboratory Manual, 2nd Edition, Cold Spring Harbor Press, Cold Spring Harbor, New York* (1989)), or similar texts. For example, the protein may be expressed in, for example, Uses of the Agents of the Invention, Section (a) Plant Constructs and Plant Transformants; Section (b) Fungal Constructs and Fungal Transformants; Section (c) Mammalian Constructs and Transformed Mammalian Cells; Section (d) Insect Constructs and Transformed Insect Cells; and Section (e) Bacterial Constructs and Transformed Bacterial Cells.

A “protein fragment” is a peptide or polypeptide molecule whose amino acid sequence comprises a subset of the amino acid sequence of that protein. A protein or fragment thereof that comprises one or more additional peptide regions not derived from that protein is a “fusion” protein. Such molecules may be derivatized to contain carbohydrate or other moieties (such as keyhole limpet hemocyanin, etc.). Fusion protein or peptide molecules of the present invention are preferably produced via recombinant means.

Another class of agents comprise protein or peptide molecules or fragments or fusions thereof encoded by SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof in which conservative, non-essential or non-relevant amino acid residues have been added, replaced or

deleted. Computerized means for designing modifications in protein structure are known in the art (Dahiyat and Mayo, *Science* 278:82-87 (1997), the entirety of which is herein incorporated by reference).

The protein molecules of the present invention include plant homologue proteins. An example of such a homologue is a homologue protein of a non-maize or non soybean plant species, that include but not limited to alfalfa, *Arabidopsis*, barley, *Brassica*, broccoli, cabbage, citrus, cotton, garlic, oat, oilseed rape, onion, canola, flax, an ornamental plant, pea, peanut, pepper, potato, rice, rye, sorghum, strawberry, sugarcane, sugarbeet, tomato, wheat, poplar, pine, fir, eucalyptus, apple, lettuce, lentils, grape, banana, tea, turf grasses, sunflower, oil palm, *Phaseolus* etc. Particularly preferred non-maize or non-soybean for use for the isolation of homologs would include, *Arabidopsis*, barley, cotton, oat, oilseed rape, rice, canola, ornamentals, sugarcane, sugarbeet, tomato, potato, wheat and turf grasses. Such a homologue can be obtained by any of a variety of methods. Most preferably, as indicated above, one or more of the disclosed sequences (SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof) will be used to define a pair of primers that may be used to isolate the homologue-encoding nucleic acid molecules from any desired species. Such molecules can be expressed to yield homologues by recombinant means.

(c) Antibodies

One aspect of the present invention concerns antibodies, single-chain antigen binding molecules, or other proteins that specifically bind to one or more of the protein or peptide molecules of the present invention and their homologues, fusions or fragments. Such antibodies may be used to quantitatively or qualitatively detect the protein or peptide molecules of the present invention. As used herein, an antibody or peptide is said to “specifically bind” to a

protein or peptide molecule of the present invention if such binding is not competitively inhibited by the presence of non-related molecules.

Nucleic acid molecules that encode all or part of the protein of the present invention can be expressed, via recombinant means, to yield protein or peptides that can in turn be used to elicit antibodies that are capable of binding the expressed protein or peptide. Such antibodies may be used in immunoassays for that protein. Such protein-encoding molecules, or their fragments may be a "fusion" molecule (i.e., a part of a larger nucleic acid molecule) such that, upon expression, a fusion protein is produced. It is understood that any of the nucleic acid molecules of the present invention may be expressed, via recombinant means, to yield proteins or peptides encoded by these nucleic acid molecules.

The antibodies that specifically bind proteins and protein fragments of the present invention may be polyclonal or monoclonal and may comprise intact immunoglobulins, or antigen binding portions of immunoglobulins fragments (such as $F(ab')$, $F(ab')_2$), or single-chain immunoglobulins producible, for example, via recombinant means. It is understood that practitioners are familiar with the standard resource materials which describe specific conditions and procedures for the construction, manipulation and isolation of antibodies (*see*, for example, Harlow and Lane, In: *Antibodies: A Laboratory Manual*, Cold Spring Harbor Press, Cold Spring Harbor, New York (1988), the entirety of which is herein incorporated by reference).

Murine monoclonal antibodies are particularly preferred. BALB/c mice are preferred for this purpose, however, equivalent strains may also be used. The animals are preferably immunized with approximately 25 μ g of purified protein (or fragment thereof) that has been emulsified in a suitable adjuvant (such as TiterMax adjuvant (Vaxcel, Norcross, GA)).

Immunization is preferably conducted at two intramuscular sites, one intraperitoneal site and one subcutaneous site at the base of the tail. An additional i.v. injection of approximately 25 µg of antigen is preferably given in normal saline three weeks later. After approximately 11 days following the second injection, the mice may be bled and the blood screened for the presence of anti-protein or peptide antibodies. Preferably, a direct binding Enzyme-Linked Immunoassay (ELISA) is employed for this purpose.

More preferably, the mouse having the highest antibody titer is given a third i.v. injection of approximately 25 µg of the same protein or fragment. The splenic leukocytes from this animal may be recovered 3 days later and then permitted to fuse, most preferably, using polyethylene glycol, with cells of a suitable myeloma cell line (such as, for example, the P3X63Ag8.653 myeloma cell line). Hybridoma cells are selected by culturing the cells under "HAT" (hypoxanthine-aminopterin-thymine) selection for about one week. The resulting clones may then be screened for their capacity to produce monoclonal antibodies ("mAbs"), preferably by direct ELISA.

In one embodiment, anti-protein or peptide monoclonal antibodies are isolated using a fusion of a protein or peptide of the present invention, or conjugate of a protein or peptide of the present invention, as immunogens. Thus, for example, a group of mice can be immunized using a fusion protein emulsified in Freund's complete adjuvant (*e.g.* approximately 50 µg of antigen per immunization). At three week intervals, an identical amount of antigen is emulsified in Freund's incomplete adjuvant and used to immunize the animals. Ten days following the third immunization, serum samples are taken and evaluated for the presence of antibody. If antibody titers are too low, a fourth booster can be employed. Polysera capable of binding the protein or peptide can also be obtained using this method.

In a preferred procedure for obtaining monoclonal antibodies, the spleens of the above-described immunized mice are removed, disrupted and immune splenocytes are isolated over a ficoll gradient. The isolated splenocytes are fused, using polyethylene glycol with BALB/c-derived HGPRT (hypoxanthine guanine phosphoribosyl transferase) deficient P3x63xAg8.653 plasmacytoma cells. The fused cells are plated into 96 well microtiter plates and screened for hybridoma fusion cells by their capacity to grow in culture medium supplemented with hypoxanthine, aminopterin and thymidine for approximately 2-3 weeks.

Hybridoma cells that arise from such incubation are preferably screened for their capacity to produce an immunoglobulin that binds to a protein of interest. An indirect ELISA may be used for this purpose. In brief, the supernatants of hybridomas are incubated in microtiter wells that contain immobilized protein. After washing, the titer of bound immunoglobulin can be determined using, for example, a goat anti-mouse antibody conjugated to horseradish peroxidase. After additional washing, the amount of immobilized enzyme is determined (for example through the use of a chromogenic substrate). Such screening is performed as quickly as possible after the identification of the hybridoma in order to ensure that a desired clone is not overgrown by non-secreting neighbor cells. Desirably, the fusion plates are screened several times since the rates of hybridoma growth vary. In a preferred embodiment, a different antigenic form may be used to screen the hybridoma. Thus, for example, the splenocytes may be immunized with one immunogen, but the resulting hybridomas can be screened using a different immunogen. It is understood that any of the protein or peptide molecules of the present invention may be used to raise antibodies.

As discussed below, such antibody molecules or their fragments may be used for diagnostic purposes. Where the antibodies are intended for diagnostic purposes, it may be

desirable to derivatize them, for example with a ligand group (such as biotin) or a detectable marker group (such as a fluorescent group, a radioisotope or an enzyme).

The ability to produce antibodies that bind the protein or peptide molecules of the present invention permits the identification of mimetic compounds of those molecules. A “mimetic compound” is a compound that is not that compound, or a fragment of that compound, but which nonetheless exhibits an ability to specifically bind to antibodies directed against that compound.

It is understood that any of the agents of the present invention can be substantially purified and/or be biologically active and/or recombinant.

Uses of the Agents of the Invention

Nucleic acid molecules and fragments thereof of the present invention may be employed to obtain other nucleic acid molecules from the same species (e.g., ESTs or fragment thereof from maize may be utilized to obtain other nucleic acid molecules from maize). Such nucleic acid molecules include the nucleic acid molecules that encode the complete coding sequence of a protein and promoters and flanking sequences of such molecules. In addition, such nucleic acid molecules include nucleic acid molecules that encode for other isozymes or gene family members. Such molecules can be readily obtained by using the above-described nucleic acid molecules or fragments thereof to screen cDNA or genomic libraries obtained from maize or soybean. Methods for forming such libraries are well known in the art.

Nucleic acid molecules and fragments thereof of the present invention may also be employed to obtain nucleic acid homologues. Such homologues include the nucleic acid molecule of other plants or other organisms (*e.g.*, alfalfa, *Arabidopsis*, barley, *Brassica*, broccoli, cabbage, citrus, cotton, garlic, oat, oilseed rape, onion, canola, flax, an ornamental plant, pea, peanut, pepper, potato, rice, rye, sorghum, strawberry, sugarcane, sugarbeet, tomato, wheat,

poplar, pine, fir, eucalyptus, apple, lettuce, lentils, grape, banana, tea, turf grasses, sunflower, oil palm, *Phaseolus*, etc.) including the nucleic acid molecules that encode, in whole or in part, protein homologues of other plant species or other organisms, sequences of genetic elements such as promoters and transcriptional regulatory elements. Such molecules can be readily obtained by using the above-described nucleic acid molecules or fragments thereof to screen cDNA or genomic libraries obtained from such plant species. Methods for forming such libraries are well known in the art. Such homologue molecules may differ in their nucleotide sequences from those found in one or more of SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof because complete complementarity is not needed for stable hybridization. The nucleic acid molecules of the present invention therefore also include molecules that, although capable of specifically hybridizing with the nucleic acid molecules may lack "complete complementarity."

Any of a variety of methods may be used to obtain one or more of the above-described nucleic acid molecules (Zamechik *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 83:4143-4146 (1986), the entirety of which is herein incorporated by reference; Goodchild *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 85:5507-5511 (1988), the entirety of which is herein incorporated by reference; Wickstrom *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 85:1028-1032 (1988), the entirety of which is herein incorporated by reference; Holt *et al.*, *Molec. Cell. Biol.* 8:963-973 (1988), the entirety of which is herein incorporated by reference; Gerwitz *et al.*, *Science* 242:1303-1306 (1988), the entirety of which is herein incorporated by reference; Anfossi *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 86:3379-3383 (1989), the entirety of which is herein incorporated by reference; Becker *et al.*, *EMBO J.* 8:3685-3691 (1989); the entirety of which is herein incorporated by reference). Automated nucleic acid synthesizers may be employed for this purpose. In lieu of such synthesis, the disclosed nucleic acid molecules may be used to define a pair of primers that can

be used with the polymerase chain reaction (Mullis *et al.*, *Cold Spring Harbor Symp. Quant. Biol.* 51:263-273 (1986); Erlich *et al.*, European Patent 50,424; European Patent 84,796; European Patent 258,017; European Patent 237,362; Mullis, European Patent 201,184; Mullis *et al.*, U.S. Patent 4,683,202; Erlich, U.S. Patent 4,582,788; and Saiki *et al.*, U.S. Patent 4,683,194, all of which are herein incorporated by reference in their entirety) to amplify and obtain any desired nucleic acid molecule or fragment.

Promoter sequence(s) and other genetic elements, including but not limited to transcriptional regulatory flanking sequences, associated with one or more of the disclosed nucleic acid sequences can also be obtained using the disclosed nucleic acid sequence provided herein. In one embodiment, such sequences are obtained by incubating EST nucleic acid molecules or preferably fragments thereof with members of genomic libraries (*e.g.* maize and soybean) and recovering clones that hybridize to the EST nucleic acid molecule or fragment thereof. In a second embodiment, methods of "chromosome walking," or inverse PCR may be used to obtain such sequences (Frohman *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 85:8998-9002 (1988); Ohara *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 86:5673-5677 (1989); Pang *et al.*, *Biotechniques* 22:1046-1048 (1977); Huang *et al.*, *Methods Mol. Biol.* 69:89-96 (1997); Huang *et al.*, *Method Mol. Biol.* 67:287-294 (1997); Benkel *et al.*, *Genet. Anal.* 13:123-127 (1996); Hartl *et al.*, *Methods Mol. Biol.* 58:293-301 (1996), all of which are herein incorporated by reference in their entirety).

The nucleic acid molecules of the present invention may be used to isolate promoters of cell enhanced, cell specific, tissue enhanced, tissue specific, developmentally or environmentally regulated expression profiles. Isolation and functional analysis of the 5' flanking promoter sequences of these genes from genomic libraries, for example, using genomic screening methods

and PCR techniques would result in the isolation of useful promoters and transcriptional regulatory elements. These methods are known to those of skill in the art and have been described (See, for example, Birren *et al.*, *Genome Analysis: Analyzing DNA*, 1, (1997), Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y., the entirety of which is herein incorporated by reference). Promoters obtained utilizing the nucleic acid molecules of the present invention could also be modified to affect their control characteristics. Examples of such modifications would include but are not limited to enhanced sequences as reported in Uses of the Agents of the Invention, Section (a) Plant Constructs and Plant Transformants. Such genetic elements could be used to enhance gene expression of new and existing traits for crop improvements.

In one sub-aspect, such an analysis is conducted by determining the presence and/or identity of polymorphism(s) by one or more of the nucleic acid molecules of the present invention and more preferably one or more of the EST nucleic acid molecule or fragment thereof which are associated with a phenotype, or a predisposition to that phenotype.

Any of a variety of molecules can be used to identify such polymorphism(s). In one embodiment, one or more of the EST nucleic acid molecules (or a sub-fragment thereof) may be employed as a marker nucleic acid molecule to identify such polymorphism(s). Alternatively, such polymorphisms can be detected through the use of a marker nucleic acid molecule or a marker protein that is genetically linked to (i.e., a polynucleotide that co-segregates with) such polymorphism(s).

In an alternative embodiment, such polymorphisms can be detected through the use of a marker nucleic acid molecule that is physically linked to such polymorphism(s). For this purpose, marker nucleic acid molecules comprising a nucleotide sequence of a polynucleotide

located within 1mb of the polymorphism(s) and more preferably within 100kb of the polymorphism(s) and most preferably within 10kb of the polymorphism(s) can be employed.

The genomes of animals and plants naturally undergo spontaneous mutation in the course of their continuing evolution (Gusella, *Ann. Rev. Biochem.* 55:831-854 (1986)). A "polymorphism" is a variation or difference in the sequence of the gene or its flanking regions that arises in some of the members of a species. The variant sequence and the "original" sequence co-exist in the species' population. In some instances, such co-existence is in stable or quasi-stable equilibrium.

A polymorphism is thus said to be "allelic," in that, due to the existence of the polymorphism, some members of a species may have the original sequence (i.e., the original "allele") whereas other members may have the variant sequence (i.e., the variant "allele"). In the simplest case, only one variant sequence may exist and the polymorphism is thus said to be di-allelic. In other cases, the species' population may contain multiple alleles and the polymorphism is termed tri-allelic, etc. A single gene may have multiple different unrelated polymorphisms. For example, it may have a di-allelic polymorphism at one site and a multi-allelic polymorphism at another site.

The variation that defines the polymorphism may range from a single nucleotide variation to the insertion or deletion of extended regions within a gene. In some cases, the DNA sequence variations are in regions of the genome that are characterized by short tandem repeats (STRs) that include tandem di- or tri-nucleotide repeated motifs of nucleotides. Polymorphisms characterized by such tandem repeats are referred to as "variable number tandem repeat" ("VNTR") polymorphisms. VNTRs have been used in identity analysis (Weber, U.S. Patent 5,075,217; Armour *et al.*, *FEBS Lett.* 307:113-115 (1992); Jones *et al.*, *Eur. J. Haematol.*

39:144-147 (1987); Horn *et al.*, PCT Patent Application WO91/14003; Jeffreys, European Patent Application 370,719; Jeffreys, U.S. Patent 5,175,082; Jeffreys *et al.*, *Amer. J. Hum. Genet.* 39:11-24 (1986); Jeffreys *et al.*, *Nature* 316:76-79 (1985); Gray *et al.*, *Proc. R. Acad. Soc. Lond.* 243:241-253 (1991); Moore *et al.*, *Genomics* 10:654-660 (1991); Jeffreys *et al.*, *Anim. Genet.* 18:1-15 (1987); Hillel *et al.*, *Anim. Genet.* 20:145-155 (1989); Hillel *et al.*, *Genet.* 124:783-789 (1990), all of which are herein incorporated by reference in their entirety).

The detection of polymorphic sites in a sample of DNA may be facilitated through the use of nucleic acid amplification methods. Such methods specifically increase the concentration of polynucleotides that span the polymorphic site, or include that site and sequences located either distal or proximal to it. Such amplified molecules can be readily detected by gel electrophoresis or other means.

The most preferred method of achieving such amplification employs the polymerase chain reaction ("PCR") (Mullis *et al.*, *Cold Spring Harbor Symp. Quant. Biol.* 51:263-273 (1986); Erlich *et al.*, European Patent Appln. 50,424; European Patent Appln. 84,796; European Patent Application 258,017; European Patent Appln. 237,362; Mullis, European Patent Appln. 201,184; Mullis *et al.*, U.S. Patent No. 4,683,202; Erlich, U.S. Patent No. 4,582,788; and Saiki *et al.*, U.S. Patent No. 4,683,194), using primer pairs that are capable of hybridizing to the proximal sequences that define a polymorphism in its double-stranded form.

In lieu of PCR, alternative methods, such as the "Ligase Chain Reaction" ("LCR") may be used (Barany, *Proc. Natl. Acad. Sci. (U.S.A.)* 88:189-193 (1991), the entirety of which is herein incorporated by reference). LCR uses two pairs of oligonucleotide probes to exponentially amplify a specific target. The sequences of each pair of oligonucleotides is selected to permit the pair to hybridize to abutting sequences of the same strand of the target.

Such hybridization forms a substrate for a template-dependent ligase. As with PCR, the resulting products thus serve as a template in subsequent cycles and an exponential amplification of the desired sequence is obtained.

LCR can be performed with oligonucleotides having the proximal and distal sequences of the same strand of a polymorphic site. In one embodiment, either oligonucleotide will be designed to include the actual polymorphic site of the polymorphism. In such an embodiment, the reaction conditions are selected such that the oligonucleotides can be ligated together only if the target molecule either contains or lacks the specific nucleotide that is complementary to the polymorphic site present on the oligonucleotide. Alternatively, the oligonucleotides may be selected such that they do not include the polymorphic site (see, Segev, PCT Application WO 90/01069, the entirety of which is herein incorporated by reference).

The "Oligonucleotide Ligation Assay" ("OLA") may alternatively be employed (Landegren *et al.*, *Science* 241:1077-1080 (1988), the entirety of which is herein incorporated by reference). The OLA protocol uses two oligonucleotides which are designed to be capable of hybridizing to abutting sequences of a single strand of a target. OLA, like LCR, is particularly suited for the detection of point mutations. Unlike LCR, however, OLA results in "linear" rather than exponential amplification of the target sequence.

Nickerson *et al.*, have described a nucleic acid detection assay that combines attributes of PCR and OLA (Nickerson *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 87:8923-8927 (1990), the entirety of which is herein incorporated by reference). In this method, PCR is used to achieve the exponential amplification of target DNA, which is then detected using OLA. In addition to requiring multiple and separate, processing steps, one problem associated with such combinations is that they inherit all of the problems associated with PCR and OLA.

Schemes based on ligation of two (or more) oligonucleotides in the presence of nucleic acid having the sequence of the resulting "di-oligonucleotide", thereby amplifying the di-oligonucleotide, are also known (Wu *et al.*, *Genomics* 4:560-569 (1989), the entirety of which is herein incorporated by reference) and may be readily adapted to the purposes of the present invention.

Other known nucleic acid amplification procedures, such as allele-specific oligomers, branched DNA technology, transcription-based amplification systems, or isothermal amplification methods may also be used to amplify and analyze such polymorphisms (Malek *et al.*, U.S. Patent 5,130,238; Davey *et al.*, European Patent Application 329,822; Schuster *et al.*, U.S. Patent 5,169,766; Miller *et al.*, PCT Patent Application WO 89/06700; Kwoh *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 86:1173-1177 (1989); Gingeras *et al.*, PCT Patent Application WO 88/10315; Walker *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 89:392-396 (1992), all of which are herein incorporated by reference in their entirety).

The identification of a polymorphism can be determined in a variety of ways. By correlating the presence or absence of it in a plant with the presence or absence of a phenotype, it is possible to predict the phenotype of that plant. If a polymorphism creates or destroys a restriction endonuclease cleavage site, or if it results in the loss or insertion of DNA (e.g., a VNTR polymorphism), it will alter the size or profile of the DNA fragments that are generated by digestion with that restriction endonuclease. As such, individuals that possess a variant sequence can be distinguished from those having the original sequence by restriction fragment analysis. Polymorphisms that can be identified in this manner are termed "restriction fragment length polymorphisms" ("RFLPs"). RFLPs have been widely used in human and plant genetic analyses (Glassberg, UK Patent Application 2135774; Skolnick *et al.*, *Cytogen. Cell Genet.*

32:58-67 (1982); Botstein *et al.*, *Ann. J. Hum. Genet.* 32:314-331 (1980); Fischer *et al.*, (PCT Application WO90/13668); Uhlen, PCT Application WO90/11369).

Polymorphisms can also be identified by Single Strand Conformation Polymorphism (SSCP) analysis. SSCP is a method capable of identifying most sequence variations in a single strand of DNA, typically between 150 and 250 nucleotides in length (Elles, *Methods in Molecular Medicine: Molecular Diagnosis of Genetic Diseases*, Humana Press (1996), the entirety of which is herein incorporated by reference); Orita *et al.*, *Genomics* 5:874-879 (1989), the entirety of which is herein incorporated by reference). Under denaturing conditions a single strand of DNA will adopt a conformation that is uniquely dependent on its sequence conformation. This conformation usually will be different, even if only a single base is changed. Most conformations have been reported to alter the physical configuration or size sufficiently to be detectable by electrophoresis. A number of protocols have been described for SSCP including, but not limited to, Lee *et al.*, *Anal. Biochem.* 205:289-293 (1992), the entirety of which is herein incorporated by reference; Suzuki *et al.*, *Anal. Biochem.* 192:82-84 (1991), the entirety of which is herein incorporated by reference; Lo *et al.*, *Nucleic Acids Research* 20:1005-1009 (1992), the entirety of which is herein incorporated by reference; Sarkar *et al.*, *Genomics* 13:441-443 (1992), the entirety of which is herein incorporated by reference. It is understood that one or more of the nucleic acids of the present invention, may be utilized as markers or probes to detect polymorphisms by SSCP analysis.

Polymorphisms may also be found using a DNA fingerprinting technique called amplified fragment length polymorphism (AFLP), which is based on the selective PCR amplification of restriction fragments from a total digest of genomic DNA to profile that DNA (Vos *et al.*, *Nucleic Acids Res.* 23:4407-4414 (1995), the entirety of which is herein incorporated

by reference). This method allows for the specific co-amplification of high numbers of restriction fragments, which can be visualized by PCR without knowledge of the nucleic acid sequence.

AFLP employs basically three steps. Initially, a sample of genomic DNA is cut with restriction enzymes and oligonucleotide adapters are ligated to the restriction fragments of the DNA. The restriction fragments are then amplified using PCR by using the adapter and restriction sequence as target sites for primer annealing. The selective amplification is achieved by the use of primers that extend into the restriction fragments, amplifying only those fragments in which the primer extensions match the nucleotide flanking the restriction sites. These amplified fragments are then visualized on a denaturing polyacrylamide gel.

AFLP analysis has been performed on *Salix* (Beismann *et al.*, *Mol. Ecol.* 6:989-993 (1997), the entirety of which is herein incorporated by reference), *Acinetobacter* (Janssen *et al.*, *Int. J. Syst. Bacteriol.* 47:1179-1187 (1997), the entirety of which is herein incorporated by reference), *Aeromonas popoffi* (Huys *et al.*, *Int. J. Syst. Bacteriol.* 47:1165-1171 (1997), the entirety of which is herein incorporated by reference), rice (McCouch *et al.*, *Plant Mol. Biol.* 35:89-99 (1997), the entirety of which is herein incorporated by reference; Nandi *et al.*, *Mol. Gen. Genet.* 255:1-8 (1997), the entirety of which is herein incorporated by reference; Cho *et al.*, *Genome* 39:373-378 (1996), the entirety of which is herein incorporated by reference), barley (*Hordeum vulgare*)(Simons *et al.*, *Genomics* 44:61-70 (1997), the entirety of which is herein incorporated by reference; Waugh *et al.*, *Mol. Gen. Genet.* 255:311-321 (1997), the entirety of which is herein incorporated by reference; Qi *et al.*, *Mol. Gen. Genet.* 254:330-336 (1997), the entirety of which is herein incorporated by reference; Becker *et al.*, *Mol. Gen. Genet.* 249:65-73 (1995), the entirety of which is herein incorporated by reference), potato (Van der Voort *et al.*,

Mol. Gen. Genet. 255:438-447 (1997), the entirety of which is herein incorporated by reference; Meksem *et al.*, *Mol. Gen. Genet.* 249:74-81 (1995), the entirety of which is herein incorporated by reference), *Phytophthora infestans* (Van der Lee *et al.*, *Fungal Genet. Biol.* 21:278-291 (1997), the entirety of which is herein incorporated by reference), *Bacillus anthracis* (Keim *et al.*, *J. Bacteriol.* 179:818-824 (1997), the entirety of which is herein incorporated by reference), *Astragalus cremnophylax* (Travis *et al.*, *Mol. Ecol.* 5:735-745 (1996), the entirety of which is herein incorporated by reference), *Arabidopsis* (Cnops *et al.*, *Mol. Gen. Genet.* 253:32-41 (1996), the entirety of which is herein incorporated by reference), *Escherichia coli* (Lin *et al.*, *Nucleic Acids Res.* 24:3649-3650 (1996), the entirety of which is herein incorporated by reference), *Aeromonas* (Huys *et al.*, *Int. J. Syst. Bacteriol.* 46:572-580 (1996), the entirety of which is herein incorporated by reference), nematode (Folkertsma *et al.*, *Mol. Plant Microbe Interact.* 9:47-54 (1996), the entirety of which is herein incorporated by reference), tomato (Thomas *et al.*, *Plant J.* 8:785-794 (1995), the entirety of which is herein incorporated by reference) and human (Latorra *et al.*, *PCR Methods Appl.* 3:351-358 (1994), the entirety of which is herein incorporated by reference). AFLP analysis has also been used for fingerprinting mRNA (Money *et al.*, *Nucleic Acids Res.* 24:2616-2617 (1996), the entirety of which is herein incorporated by reference; Bachem *et al.*, *Plant J.* 9:745-753 (1996), the entirety of which is herein incorporated by reference). It is understood that one or more of the nucleic acids of the present invention, may be utilized as markers or probes to detect polymorphisms by AFLP analysis or for fingerprinting RNA.

Polymorphisms may also be found using random amplified polymorphic DNA (RAPD) (Williams *et al.*, *Nucl. Acids Res.* 18:6531-6535 (1990), the entirety of which is herein incorporated by reference) and cleaveable amplified polymorphic sequences (CAPS) (Lyamichev

et al., *Science* 260:778-783 (1993), the entirety of which is herein incorporated by reference). It is understood that one or more of the nucleic acid molecules of the present invention, may be utilized as markers or probes to detect polymorphisms by RAPD or CAPS analysis.

Through genetic mapping, a fine scale linkage map can be developed using DNA markers and, then, a genomic DNA library of large-sized fragments can be screened with molecular markers linked to the desired trait. Molecular markers are advantageous for agronomic traits that are otherwise difficult to tag, such as resistance to pathogens, insects and nematodes, tolerance to abiotic stress, quality parameters and quantitative traits such as high yield potential.

The essential requirements for marker-assisted selection in a plant breeding program are: (1) the marker(s) should co-segregate or be closely linked with the desired trait; (2) an efficient means of screening large populations for the molecular marker(s) should be available; and (3) the screening technique should have high reproducibility across laboratories and preferably be economical to use and be user-friendly.

The genetic linkage of marker molecules can be established by a gene mapping model such as, without limitation, the flanking marker model reported by Lander and Botstein, *Genetics* 121:185-199 (1989) and the interval mapping, based on maximum likelihood methods described by Lander and Botstein, *Genetics* 121:185-199 (1989) and implemented in the software package MAPMAKER/QTL (Lincoln and Lander, *Mapping Genes Controlling Quantitative Traits Using MAPMAKER/QTL*, Whitehead Institute for Biomedical Research, Massachusetts, (1990). Additional software includes Qgene, Version 2.23 (1996), Department of Plant Breeding and Biometry, 266 Emerson Hall, Cornell University, Ithaca, NY, the manual of which is herein incorporated by reference in its entirety). Use of Qgene software is a particularly preferred approach.

A maximum likelihood estimate (MLE) for the presence of a marker is calculated, together with an MLE assuming no QTL effect, to avoid false positives. A \log_{10} of an odds ratio (LOD) is then calculated as: $\text{LOD} = \log_{10}(\text{MLE for the presence of a QTL} / \text{MLE given no linked QTL})$.

The LOD score essentially indicates how much more likely the data are to have arisen assuming the presence of a QTL than in its absence. The LOD threshold value for avoiding a false positive with a given confidence, say 95%, depends on the number of markers and the length of the genome. Graphs indicating LOD thresholds are set forth in Lander and Botstein, *Genetics* 121:185-199 (1989) the entirety of which is herein incorporated by reference and further described by Arús and Moreno-González, *Plant Breeding*, Hayward *et al.*, (eds.) Chapman & Hall, London, pp. 314-331 (1993), the entirety of which is herein incorporated by reference.

Additional models can be used. Many modifications and alternative approaches to interval mapping have been reported, including the use non-parametric methods (Kruglyak and Lander, *Genetics* 139:1421-1428 (1995), the entirety of which is herein incorporated by reference). Multiple regression methods or models can be also be used, in which the trait is regressed on a large number of markers (Jansen, *Biometrics in Plant Breeding*, van Oijen and Jansen (eds.), Proceedings of the Ninth Meeting of the Eucarpia Section Biometrics in Plant Breeding, The Netherlands, pp. 116-124 (1994); Weber and Wricke, *Advances in Plant Breeding*, Blackwell, Berlin, 16 (1994), both of which is herein incorporated by reference in their entirety). Procedures combining interval mapping with regression analysis, whereby the phenotype is regressed onto a single putative QTL at a given marker interval and at the same time onto a number of markers that serve as 'cofactors,' have been reported by Jansen and Stam, *Genetics*

136:1447-1455 (1994), the entirety of which is herein incorporated by reference and Zeng, *Genetics* 136:1457-1468 (1994) the entirety of which is herein incorporated by reference. Generally, the use of cofactors reduces the bias and sampling error of the estimated QTL positions (Utz and Melchinger, *Biometrics in Plant Breeding*, van Oijen and Jansen (eds.) Proceedings of the Ninth Meeting of the Eucarpia Section Biometrics in Plant Breeding, The Netherlands, pp.195-204 (1994), the entirety of which is herein incorporated by reference, thereby improving the precision and efficiency of QTL mapping (Zeng, *Genetics* 136:1457-1468 (1994)). These models can be extended to multi-environment experiments to analyze genotype-environment interactions (Jansen *et al.*, *Theo. Appl. Genet.* 91:33-37 (1995), the entirety of which is herein incorporated by reference).

Selection of an appropriate mapping populations is important to map construction. The choice of appropriate mapping population depends on the type of marker systems employed (Tanksley *et al.*, *Molecular mapping plant chromosomes. Chromosome structure and function: Impact of new concepts*, Gustafson and Appels (eds.), Plenum Press, New York, pp 157-173 (1988), the entirety of which is herein incorporated by reference). Consideration must be given to the source of parents (adapted vs. exotic) used in the mapping population. Chromosome pairing and recombination rates can be severely disturbed (suppressed) in wide crosses (adapted x exotic) and generally yield greatly reduced linkage distances. Wide crosses will usually provide segregating populations with a relatively large array of polymorphisms when compared to progeny in a narrow cross (adapted x adapted).

An F_2 population is the first generation of selfing after the hybrid seed is produced. Usually a single F_1 plant is selfed to generate a population segregating for all the genes in Mendelian (1:2:1) fashion. Maximum genetic information is obtained from a completely

classified F_2 population using a codominant marker system (Mather, *Measurement of Linkage in Heredity*, Methuen and Co., (1938), the entirety of which is herein incorporated by reference). In the case of dominant markers, progeny tests (e.g. F_3 , BCF_2) are required to identify the heterozygotes, thus making it equivalent to a completely classified F_2 population. However, this procedure is often prohibitive because of the cost and time involved in progeny testing. Progeny testing of F_2 individuals is often used in map construction where phenotypes do not consistently reflect genotype (e.g. disease resistance) or where trait expression is controlled by a QTL. Segregation data from progeny test populations (e.g. F_3 or BCF_2) can be used in map construction. Marker-assisted selection can then be applied to cross progeny based on marker-trait map associations (F_2 , F_3), where linkage groups have not been completely disassociated by recombination events (i.e., maximum disequilibrium).

Recombinant inbred lines (RIL) (genetically related lines; usually $>F_5$, developed from continuously selfing F_2 lines towards homozygosity) can be used as a mapping population. Information obtained from dominant markers can be maximized by using RIL because all loci are homozygous or nearly so. Under conditions of tight linkage (i.e., about $<10\%$ recombination), dominant and co-dominant markers evaluated in RIL populations provide more information per individual than either marker type in backcross populations (Reiter *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 89:1477-1481 (1992), the entirety of which is herein incorporated by reference). However, as the distance between markers becomes larger (i.e., loci become more independent), the information in RIL populations decreases dramatically when compared to codominant markers.

Backcross populations (e.g., generated from a cross between a successful variety (recurrent parent) and another variety (donor parent) carrying a trait not present in the former)

can be utilized as a mapping population. A series of backcrosses to the recurrent parent can be made to recover most of its desirable traits. Thus a population is created consisting of individuals nearly like the recurrent parent but each individual carries varying amounts or mosaic of genomic regions from the donor parent. Backcross populations can be useful for mapping dominant markers if all loci in the recurrent parent are homozygous and the donor and recurrent parent have contrasting polymorphic marker alleles (Reiter *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 89:1477-1481 (1992)). Information obtained from backcross populations using either codominant or dominant markers is less than that obtained from F_2 populations because one, rather than two, recombinant gametes are sampled per plant. Backcross populations, however, are more informative (at low marker saturation) when compared to RILs as the distance between linked loci increases in RIL populations (i.e. about 15% recombination). Increased recombination can be beneficial for resolution of tight linkages, but may be undesirable in the construction of maps with low marker saturation.

Near-isogenic lines (NIL) created by many backcrosses to produce an array of individuals that are nearly identical in genetic composition except for the trait or genomic region under interrogation can be used as a mapping population. In mapping with NILs, only a portion of the polymorphic loci are expected to map to a selected region.

Bulk segregant analysis (BSA) is a method developed for the rapid identification of linkage between markers and traits of interest (Michelmore *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 88:9828-9832 (1991), the entirety of which is herein incorporated by reference). In BSA, two bulked DNA samples are drawn from a segregating population originating from a single cross. These bulks contain individuals that are identical for a particular trait (resistant or susceptible to particular disease) or genomic region but arbitrary at unlinked regions (i.e. heterozygous).

Regions unlinked to the target region will not differ between the bulked samples of many individuals in BSA.

It is understood that one or more of the nucleic acid molecules of the present invention may be used as molecular markers. It is also understood that one or more of the protein molecules of the present invention may be used as molecular markers.

In accordance with this aspect of the present invention, a sample nucleic acid is obtained from plants cells or tissues. Any source of nucleic acid may be used. Preferably, the nucleic acid is genomic DNA. The nucleic acid is subjected to restriction endonuclease digestion. For example, one or more nucleic acid molecule or fragment thereof of the present invention can be used as a probe in accordance with the above-described polymorphic methods. The polymorphism obtained in this approach can then be cloned to identify the mutation at the coding region which alters the protein's structure or regulatory region of the gene which affects its expression level.

In an aspect of the present invention, one or more of the nucleic molecules of the present invention are used to determine the level (i.e., the concentration of mRNA in a sample, etc.) in a plant (preferably maize or soybean) or pattern (i.e., the kinetics of expression, rate of decomposition, stability profile, etc.) of the expression of a protein encoded in part or whole by one or more of the nucleic acid molecule of the present invention (collectively, the "Expression Response" of a cell or tissue). As used herein, the Expression Response manifested by a cell or tissue is said to be "altered" if it differs from the Expression Response of cells or tissues of plants not exhibiting the phenotype. To determine whether an Expression Response is altered, the Expression Response manifested by the cell or tissue of the plant exhibiting the phenotype is compared with that of a similar cell or tissue sample of a plant not exhibiting the phenotype. As

will be appreciated, it is not necessary to re-determine the Expression Response of the cell or tissue sample of plants not exhibiting the phenotype each time such a comparison is made; rather, the Expression Response of a particular plant may be compared with previously obtained values of normal plants. As used herein, the phenotype of the organism is any of one or more characteristics of an organism (e.g. disease resistance, pest tolerance, environmental tolerance such as tolerance to abiotic stress, male sterility, quality improvement or yield etc.). A change in genotype or phenotype may be transient or permanent. Also as used herein, a tissue sample is any sample that comprises more than one cell. In a preferred aspect, a tissue sample comprises cells that share a common characteristic (e.g. derived from root, seed, flower, leaf, stem or pollen etc.).

In one aspect of the present invention, an evaluation can be conducted to determine whether a particular mRNA molecule is present. One or more of the nucleic acid molecules of the present invention, preferably one or more of the EST nucleic acid molecules or fragments thereof of the present invention are utilized to detect the presence or quantity of the mRNA species. Such molecules are then incubated with cell or tissue extracts of a plant under conditions sufficient to permit nucleic acid hybridization. The detection of double-stranded probe-mRNA hybrid molecules is indicative of the presence of the mRNA; the amount of such hybrid formed is proportional to the amount of mRNA. Thus, such probes may be used to ascertain the level and extent of the mRNA production in a plant's cells or tissues. Such nucleic acid hybridization may be conducted under quantitative conditions (thereby providing a numerical value of the amount of the mRNA present). Alternatively, the assay may be conducted as a qualitative assay that indicates either that the mRNA is present, or that its level exceeds a user set, predefined value.

A principle of *in situ* hybridization is that a labeled, single-stranded nucleic acid probe will hybridize to a complementary strand of cellular DNA or RNA and, under the appropriate conditions, these molecules will form a stable hybrid. When nucleic acid hybridization is combined with histological techniques, specific DNA or RNA sequences can be identified within a single cell. An advantage of *in situ* hybridization over more conventional techniques for the detection of nucleic acids is that it allows an investigator to determine the precise spatial population (Angerer *et al.*, *Dev. Biol.* 101:477-484 (1984), the entirety of which is herein incorporated by reference; Angerer *et al.*, *Dev. Biol.* 112:157-166 (1985), the entirety of which is herein incorporated by reference; Dixon *et al.*, *EMBO J.* 10:1317-1324 (1991), the entirety of which is herein incorporated by reference). *In situ* hybridization may be used to measure the steady-state level of RNA accumulation. It is a sensitive technique and RNA sequences present in as few as 5-10 copies per cell can be detected (Hardin *et al.*, *J. Mol. Biol.* 202:417-431 (1989), the entirety of which is herein incorporated by reference). A number of protocols have been devised for *in situ* hybridization, each with tissue preparation, hybridization and washing conditions (Meyerowitz, *Plant Mol. Biol. Rep.* 5:242-250 (1987), the entirety of which is herein incorporated by reference; Cox and Goldberg, In: *Plant Molecular Biology: A Practical Approach*, Shaw (ed.), pp 1-35, IRL Press, Oxford (1988), the entirety of which is herein incorporated by reference; Raikhel *et al.*, *In situ RNA hybridization in plant tissues*, In: *Plant Molecular Biology Manual*, vol. B9:1-32, Kluwer Academic Publisher, Dordrecht, Belgium (1989), the entirety of which is herein incorporated by reference).

In situ hybridization also allows for the localization of proteins within a tissue or cell (Wilkinson, *In Situ Hybridization*, Oxford University Press, Oxford (1992), the entirety of which is herein incorporated by reference; Langdale, *In Situ Hybridization* In: *The Maize Handbook*,

Freeling and Walbot (eds.), pp 165-179, Springer-Verlag, New York (1994), the entirety of which is herein incorporated by reference). It is understood that one or more of the molecules of the present invention, preferably one or more of the EST nucleic acid molecules or fragments thereof of the present invention or one or more of the antibodies of the present invention may be utilized to detect the level or pattern of a transcription factor or mRNA thereof by *in situ* hybridization.

Fluorescent *in situ* hybridization allows the localization of a particular DNA sequence along a chromosome which is useful, among other uses, for gene mapping, following chromosomes in hybrid lines or detecting chromosomes with translocations, transversions or deletions. *In situ* hybridization has been used to identify chromosomes in several plant species (Griffor *et al.*, *Plant Mol. Biol.* 17:101-109 (1991), the entirety of which is herein incorporated by reference; Gustafson *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 87:1899-1902 (1990), herein incorporated by reference; Mukai and Gill, *Genome* 34:448-452 (1991), the entirety of which is herein incorporated by reference; Schwarzacher and Heslop-Harrison, *Genome* 34:317-323 (1991); Wang *et al.*, *Jpn. J. Genet.* 66:313-316 (1991), the entirety of which is herein incorporated by reference; Parra and Windle, *Nature Genetics* 5:17-21 (1993), the entirety of which is herein incorporated by reference). It is understood that the nucleic acid molecules of the present invention may be used as probes or markers to localize sequences along a chromosome.

Another method to localize the expression of a molecule is tissue printing. Tissue printing provides a way to screen, at the same time on the same membrane many tissue sections from different plants or different developmental stages. Tissue-printing procedures utilize films designed to immobilize proteins and nucleic acids. In essence, a freshly cut section of a tissue is pressed gently onto nitrocellulose paper, nylon membrane or polyvinylidene difluoride

membrane. Such membranes are commercially available (*e.g.* Millipore, Bedford, Massachusetts U.S.A.). The contents of the cut cell transfer onto the membrane and the contents are immobilized to the membrane. The immobilized contents form a latent print that can be visualized with appropriate probes. When a plant tissue print is made on nitrocellulose paper, the cell walls leave a physical print that makes the anatomy visible without further treatment (Varner and Taylor, *Plant Physiol.* 91:31-33 (1989), the entirety of which is herein incorporated by reference).

Tissue printing on substrate films is described by Daoust, *Exp. Cell Res.* 12:203-211 (1957), the entirety of which is herein incorporated by reference, who detected amylase, protease, ribonuclease and deoxyribonuclease in animal tissues using starch, gelatin and agar films. These techniques can be applied to plant tissues (Yomo and Taylor, *Planta* 112:35-43 (1973); the entirety of which is herein incorporated by reference; Harris and Chrispeels, *Plant Physiol.* 56:292-299 (1975), the entirety of which is herein incorporated by reference). Advances in membrane technology have increased the range of applications of Daoust's tissue-printing techniques allowing (Cassab and Varner, *J. Cell. Biol.* 105:2581-2588 (1987), the entirety of which is herein incorporated by reference) the histochemical localization of various plant enzymes and deoxyribonuclease on nitrocellulose paper and nylon (Spruce *et al.*, *Phytochemistry* 26:2901-2903 (1987), the entirety of which is herein incorporated by reference; Barres *et al.*, *Neuron* 5:527-544 (1990), the entirety of which is herein incorporated by reference; Reid and Pont-Lezica, *Tissue Printing: Tools for the Study of Anatomy, Histochemistry and Gene Expression*, Academic Press, New York, New York (1992), the entirety of which is herein incorporated by reference; Reid *et al.*, *Plant Physiol.* 93:160-165 (1990), the entirety of which is

herein incorporated by reference; Ye *et al.*, *Plant J.* 1:175-183 (1991), the entirety of which is herein incorporated by reference).

It is understood that one or more of the molecules of the present invention, preferably one or more of the EST nucleic acid molecules or fragments thereof of the present invention or one or more of the antibodies of the present invention may be utilized to detect the presence or quantity of a transcription factor by tissue printing.

Further it is also understood that any of the nucleic acid molecules of the present invention may be used as marker nucleic acids and or probes in connection with methods that require probes or marker nucleic acids. As used herein, a probe is an agent that is utilized to determine an attribute or feature (e.g. presence or absence, location, correlation, etc.) of a molecule, cell, tissue or plant. As used herein, a marker nucleic acid is a nucleic acid molecule that is utilized to determine an attribute or feature (e.g., presence or absence, location, correlation, etc.) or a molecule, cell, tissue or plant.

A microarray-based method for high-throughput monitoring of plant gene expression may be utilized to measure gene-specific hybridization targets. This 'chip'-based approach involves using microarrays of nucleic acid molecules as gene-specific hybridization targets to quantitatively measure expression of the corresponding plant genes (Schena *et al.*, *Science* 270:467-470 (1995), the entirety of which is herein incorporated by reference; Shalon, Ph.D. Thesis, Stanford University (1996), the entirety of which is herein incorporated by reference). Every nucleotide in a large sequence can be queried at the same time. Hybridization can be used to efficiently analyze nucleotide sequences.

Several microarray methods have been described. One method compares the sequences to be analyzed by hybridization to a set of oligonucleotides representing all possible

subsequences (Bains and Smith, *J. Theor. Biol.* 135:303-307 (1989), the entirety of which is herein incorporated by reference). A second method hybridizes the sample to an array of oligonucleotide or cDNA molecules. An array consisting of oligonucleotides complementary to subsequences of a target sequence can be used to determine the identity of a target sequence, measure its amount and detect differences between the target and a reference sequence. Nucleic acid molecules microarrays may also be screened with protein molecules or fragments thereof to determine nucleic acid molecules that specifically bind protein molecules or fragments thereof.

The microarray approach may be used with polypeptide targets (U.S. Patent No. 5,445,934; U.S. Patent No. 5,143,854; U.S. Patent No. 5,079,600; U.S. Patent No. 4,923,901, all of which are herein incorporated by reference in their entirety). Essentially, polypeptides are synthesized on a substrate (microarray) and these polypeptides can be screened with either protein molecules or fragments thereof or nucleic acid molecules in order to screen for either protein molecules or fragments thereof or nucleic acid molecules that specifically bind the target polypeptides. (Fodor *et al.*, *Science* 251:767-773 (1991), the entirety of which is herein incorporated by reference). It is understood that one or more of the nucleic acid molecules or protein or fragments thereof of the present invention may be utilized in a microarray based method.

In a preferred embodiment of the present invention microarrays may be prepared that comprise nucleic acid molecules where such nucleic acid molecules encode at least one, preferably at least two, more preferably at least three transcription factors. In a preferred embodiment the nucleic acid molecules are selected from the group consisting of a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or fragment thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis*

thaliana HLH transcription factor or fragment thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or fragment thereof, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or fragment thereof and a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* other transcription factor or fragment thereof.

Site directed mutagenesis may be utilized to modify nucleic acid sequences, particularly as it is a technique that allows one or more of the amino acids encoded by a nucleic acid molecule to be altered (e.g. a threonine to be replaced by a methionine). Three basic methods for site directed mutagenesis are often employed. These are cassette mutagenesis (Wells *et al.*, *Gene* 34:315-323 (1985), the entirety of which is herein incorporated by reference), primer extension (Gilliam *et al.*, *Gene* 12:129-137 (1980), the entirety of which is herein incorporated by reference; Zoller and Smith, *Methods Enzymol.* 100:468-500 (1983), the entirety of which is herein incorporated by reference; Dalbadie-McFarland *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 79:6409-6413 (1982), the entirety of which is herein incorporated by reference) and methods based upon PCR (Scharf *et al.*, *Science* 233:1076-1078 (1986), the entirety of which is herein incorporated by reference; Higuchi *et al.*, *Nucleic Acids Res.* 16:7351-7367 (1988), the entirety of which is herein incorporated by reference). Site directed mutagenesis approaches are also described in European Patent 0 385 962, the entirety of which is herein incorporated by reference; European Patent 0 359 472, the entirety of which is herein incorporated by reference; and PCT Patent Application WO 93/07278, the entirety of which is herein incorporated by reference.

Site directed mutagenesis strategies have been applied to plants for both *in vitro* as well as *in vivo* site directed mutagenesis (Lanz *et al.*, *J. Biol. Chem.* 266:9971-9976 (1991), the

entirety of which is herein incorporated by reference; Kovgan and Zhdanov, *Biokhimiya* 5:148-154; No. 207160n, Chemical Abstracts 110:225 (1989), the entirety of which is herein incorporated by reference; Ge *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 86:4037-4041 (1989), the entirety of which is herein incorporated by reference; Zhu *et al.*, *J. Biol. Chem.* 271:18494-18498 (1996), the entirety of which is herein incorporated by reference; Chu *et al.*, *Biochemistry* 33:6150-6157 (1994), the entirety of which is herein incorporated by reference; Small *et al.*, *EMBO J.* 11:1291-1296 (1992), the entirety of which is herein incorporated by reference; Cho *et al.*, *Mol. Biotechnol.* 8:13-16 (1997), the entirety of which is herein incorporated by reference; Kita *et al.*, *J. Biol. Chem.* 271:26529-26535 (1996), the entirety of which is herein incorporated by reference; Jin *et al.*, *Mol. Microbiol.* 7:555-562 (1993), the entirety of which is herein incorporated by reference; Hatfield and Vierstra, *J. Biol. Chem.* 267:14799-14803 (1992), the entirety of which is herein incorporated by reference; Zhao *et al.*, *Biochemistry* 31:5093-5099 (1992), the entirety of which is herein incorporated by reference).

Any of the nucleic acid molecules of the present invention may either be modified by site directed mutagenesis or used as, for example, nucleic acid molecules that are used to target other nucleic acid molecules for modification. It is understood that mutants with more than one altered nucleotide can be constructed using techniques that practitioners are familiar with such as isolating restriction fragments and ligating such fragments into an expression vector (*see, for example, Sambrook et al., Molecular Cloning: A Laboratory Manual*, Cold Spring Harbor Press (1989)).

Sequence-specific DNA-binding proteins play a role in the regulation of transcription. The isolation of recombinant cDNAs encoding these proteins facilitates the biochemical analysis of their structural and functional properties. Genes encoding such DNA-binding proteins have

been isolated using classical genetics (Vollbrecht *et al.*, *Nature* 350: 241-243 (1991), the entirety of which is herein incorporated by reference) and molecular biochemical approaches, including the screening of recombinant cDNA libraries with antibodies (Landschulz *et al.*, *Genes Dev.* 2:786-800 (1988), the entirety of which is herein incorporated by reference) or DNA probes (Bodner *et al.*, *Cell* 55:505-518 (1988), the entirety of which is herein incorporated by reference). In addition, an *in situ* screening procedure has been used and has facilitated the isolation of sequence-specific DNA-binding proteins from various plant species (Gilmartin *et al.*, *Plant Cell* 4:839-849 (1992), the entirety of which is herein incorporated by reference; Schindler *et al.*, *EMBO J.* 11:1261-1273 (1992), the entirety of which is herein incorporated by reference). An *in situ* screening protocol does not require the purification of the protein of interest (Vinson *et al.*, *Genes Dev.* 2:801-806 (1988), the entirety of which is herein incorporated by reference; Singh *et al.*, *Cell* 52:415-423 (1988), the entirety of which is herein incorporated by reference).

Two steps may be employed to characterize DNA-protein interactions. The first is to identify promoter fragments that interact with DNA-binding proteins, to titrate binding activity, to determine the specificity of binding and to determine whether a given DNA-binding activity can interact with related DNA sequences (Sambrook *et al.*, *Molecular Cloning: A Laboratory Manual*, 2nd edition, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York (1989)). Electrophoretic mobility-shift assay is a widely used assay. The assay provides a rapid and sensitive method for detecting DNA-binding proteins based on the observation that the mobility of a DNA fragment through a nondenaturing, low-ionic strength polyacrylamide gel is retarded upon association with a DNA-binding protein (Fried and Crother, *Nucleic Acids Res.* 9:6505-6525 (1981), the entirety of which is herein incorporated by reference). When one or

more specific binding activities have been identified, the exact sequence of the DNA bound by the protein may be determined. Several procedures for characterizing protein/DNA-binding sites are used, including methylation and ethylation interference assays (Maxam and Gilbert, *Methods Enzymol.* 65:499-560 (1980), the entirety of which is herein incorporated by reference; Wissman and Hillen, *Methods Enzymol.* 208:365-379 (1991), the entirety of which is herein incorporated by reference), footprinting techniques employing DNase I (Galas and Schmitz, *Nucleic Acids Res.* 5:3157-3170 (1978), the entirety of which is herein incorporated by reference), 1,10-phenanthroline-copper ion methods (Sigman *et al.*, *Methods Enzymol.* 208:414-433 (1991), the entirety of which is herein incorporated by reference) and hydroxyl radicals methods (Dixon *et al.*, *Methods Enzymol.* 208:414-433 (1991), the entirety of which is herein incorporated by reference). It is understood that one or more of the nucleic acid molecules of the present invention may be utilized to identify a protein or fragment thereof that specifically binds to a nucleic acid molecule of the present invention. It is also understood that one or more of the protein molecules or fragments thereof of the present invention may be utilized to identify a nucleic acid molecule that specifically binds to it.

A two-hybrid system is based on the fact that many cellular functions are carried out by proteins, such as transcription factors, that interact (physically) with one another. Two-hybrid systems have been used to probe the function of new proteins (Chien *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 88:9578-9582 (1991) the entirety of which is herein incorporated by reference; Durfee *et al.*, *Genes Dev.* 7:555-569 (1993) the entirety of which is herein incorporated by reference; Choi *et al.*, *Cell* 78:499-512 (1994), the entirety of which is herein incorporated by reference; Kranz *et al.*, *Genes Dev.* 8:313-327 (1994), the entirety of which is herein incorporated by reference).

Interaction mating techniques have facilitated a number of two-hybrid studies of protein-protein interaction. Interaction mating has been used to examine interactions between small sets of tens of proteins (Finley and Brent, *Proc. Natl. Acad. Sci. (U.S.A.)* 91:12098-12984 (1994), the entirety of which is herein incorporated by reference), larger sets of hundreds of proteins (Bendixen *et al.*, *Nucl. Acids Res.* 22:1778-1779 (1994), the entirety of which is herein incorporated by reference) and to comprehensively map proteins encoded by a small genome (Bartel *et al.*, *Nature Genetics* 12:72-77 (1996), the entirety of which is herein incorporated by reference). This technique utilizes proteins fused to the DNA-binding domain and proteins fused to the activation domain. They are expressed in two different haploid yeast strains of opposite mating type and the strains are mated to determine if the two proteins interact. Mating occurs when haploid yeast strains come into contact and result in the fusion of the two haploids into a diploid yeast strain. An interaction can be determined by the activation of a two-hybrid reporter gene in the diploid strain. An advantage of this technique is that it reduces the number of yeast transformations needed to test individual interactions. It is understood that the protein-protein interactions of protein or fragments thereof of the present invention may be investigated using the two-hybrid system and that any of the nucleic acid molecules of the present invention that encode such proteins or fragments thereof may be used to transform yeast in the two-hybrid system.

(a) Plant Constructs and Plant Transformants

One or more of the nucleic acid molecules of the present invention may be used in plant transformation or transfection. Exogenous genetic material may be transferred into a plant cell and the plant cell regenerated into a whole, fertile or sterile plant. Exogenous genetic material is any genetic material, whether naturally occurring or otherwise, from any source that is capable of



being inserted into any organism. Such genetic material may be transferred into either monocotyledons and dicotyledons including, but not limited to maize (pp 63-69), soybean (pp 50-60), *Arabidopsis* (p 45), phaseolus (pp 47-49), peanut (pp 49-50), alfalfa (p 60), wheat (pp 69-71), rice (pp 72-79), oat (pp 80-81), sorghum (p 83), rye (p 84), tritordeum (p 84), millet (p85), fescue (p 85), perennial ryegrass (p 86), sugarcane (p87), cranberry (p101), papaya (pp 101-102), banana (p 103), banana (p 103), muskmelon (p 104), apple (p 104), cucumber (p 105), dendrobium (p 109), gladiolus (p 110), chrysanthemum (p 110), liliacea (p 111), cotton (pp113-114), eucalyptus (p 115), sunflower (p 118), canola (p 118), turfgrass (p121), sugarbeet (p 122), coffee (p 122) and dioscorea (p 122), (Christou, In: *Particle Bombardment for Genetic Engineering of Plants*, Biotechnology Intelligence Unit. Academic Press, San Diego, California (1996), the entirety of which is herein incorporated by reference).

Transfer of a nucleic acid that encodes for a protein can result in overexpression of that protein in a transformed cell or transgenic plant. One or more of the proteins or fragments thereof encoded by nucleic acid molecules of the present invention may be overexpressed in a transformed cell or transformed plant. Particularly, any of the transcription factors or fragments thereof may be overexpressed in a transformed cell or transgenic plant. Such overexpression may be the result of transient or stable transfer of the exogenous genetic material.

Exogenous genetic material may be transferred into a plant cell and the plant cell by the use of a DNA vector or construct designed for such a purpose. Design of such a vector is generally within the skill of the art (See, *Plant Molecular Biology: A Laboratory Manual*, Clark (ed.), Springer, New York (1997), the entirety of which is herein incorporated by reference).

A construct or vector may include a plant promoter to express the protein or protein fragment of choice. A number of promoters which are active in plant cells have been described

in the literature. These include the nopaline synthase (NOS) promoter (Ebert *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 84:5745-5749 (1987), the entirety of which is herein incorporated by reference), the octopine synthase (OCS) promoter (which are carried on tumor-inducing plasmids of *Agrobacterium tumefaciens*), the caulimovirus promoters such as the cauliflower mosaic virus (CaMV) 19S promoter (Lawton *et al.*, *Plant Mol. Biol.* 9:315-324 (1987), the entirety of which is herein incorporated by reference) and the CAMV 35S promoter (Odell *et al.*, *Nature* 313:810-812 (1985), the entirety of which is herein incorporated by reference), the figwort mosaic virus 35S-promoter, the light-inducible promoter from the small subunit of ribulose-1,5-bis-phosphate carboxylase (ssRUBISCO), the Adh promoter (Walker *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 84:6624-6628 (1987), the entirety of which is herein incorporated by reference), the sucrose synthase promoter (Yang *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 87:4144-4148 (1990), the entirety of which is herein incorporated by reference), the R gene complex promoter (Chandler *et al.*, *The Plant Cell* 1:1175-1183 (1989), the entirety of which is herein incorporated by reference) and the chlorophyll a/b binding protein gene promoter, etc. These promoters have been used to create DNA constructs which have been expressed in plants; *see, e.g.*, PCT publication WO 84/02913, herein incorporated by reference in its entirety.

Promoters which are known or are found to cause transcription of DNA in plant cells can be used in the present invention. Such promoters may be obtained from a variety of sources such as plants and plant viruses. It is preferred that the particular promoter selected should be capable of causing sufficient expression to result in the production of an effective amount of the transcription factor to cause the desired phenotype. In addition to promoters that are known to cause transcription of DNA in plant cells, other promoters may be identified for use in the

current invention by screening a plant cDNA library for genes which are selectively or preferably expressed in the target tissues or cells.

For the purpose of expression in source tissues of the plant, such as the leaf, seed, root or stem, it is preferred that the promoters utilized in the present invention have relatively high expression in these specific tissues. For this purpose, one may choose from a number of promoters for genes with tissue- or cell-specific or -enhanced expression. Examples of such promoters reported in the literature include the chloroplast glutamine synthetase GS2 promoter from pea (Edwards *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 87:3459-3463 (1990), herein incorporated by reference in its entirety), the chloroplast fructose-1,6-biphosphatase (FBPase) promoter from wheat (Lloyd *et al.*, *Mol. Gen. Genet.* 225:209-216 (1991), herein incorporated by reference in its entirety), the nuclear photosynthetic ST-LS1 promoter from potato (Stockhaus *et al.*, *EMBO J.* 8:2445-2451 (1989), herein incorporated by reference in its entirety), the serine/threonine kinase (PAL) promoter and the glucoamylase (CHS) promoter from *Arabidopsis thaliana*. Also reported to be active in photosynthetically active tissues are the ribulose-1,5-bisphosphate carboxylase (RbcS) promoter from eastern larch (*Larix laricina*), the promoter for the *cab* gene, *cab6*, from pine (Yamamoto *et al.*, *Plant Cell Physiol.* 35:773-778 (1994), herein incorporated by reference in its entirety), the promoter for the *Cab-1* gene from wheat (Fejes *et al.*, *Plant Mol. Biol.* 15:921-932 (1990), herein incorporated by reference in its entirety), the promoter for the *CAB-1* gene from spinach (Lubberstedt *et al.*, *Plant Physiol.* 104:997-1006 (1994), herein incorporated by reference in its entirety), the promoter for the *cab1R* gene from rice (Luan *et al.*, *Plant Cell.* 4:971-981 (1992), the entirety of which is herein incorporated by reference), the pyruvate, orthophosphate dikinase (PPDK) promoter from maize (Matsuoka *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 90: 9586-9590 (1993), herein incorporated by reference in its

entirety), the promoter for the tobacco Lhcb1*2 gene (Cerdan *et al.*, *Plant Mol. Biol.* 33:245-255 (1997), herein incorporated by reference in its entirety), the *Arabidopsis thaliana* SUC2 sucrose-H⁺ symporter promoter (Truernit *et al.*, *Planta.* 196:564-570 (1995), herein incorporated by reference in its entirety) and the promoter for the thylakoid membrane proteins from spinach (psaD, psaF, psaE, PC, FNR, atpC, atpD, cab, rbcS). Other promoters for the chlorophyll a/b-binding proteins may also be utilized in the present invention, such as the promoters for Lhcb gene and PsbP gene from white mustard (*Sinapis alba*; Kretsch *et al.*, *Plant Mol. Biol.* 28:219-229 (1995), the entirety of which is herein incorporated by reference).

For the purpose of expression in sink tissues of the plant, such as the tuber of the potato plant, the fruit of tomato, or the seed of maize, wheat, rice and barley, it is preferred that the promoters utilized in the present invention have relatively high expression in these specific tissues. A number of promoters for genes with tuber-specific or -enhanced expression are known, including the class I patatin promoter (Bevan *et al.*, *EMBO J.* 8:1899-1906 (1986); Jefferson *et al.*, *Plant Mol. Biol.* 14:995-1006 (1990), both of which are herein incorporated by reference in its entirety), the promoter for the potato tuber ADPGPP genes, both the large and small subunits, the sucrose synthase promoter (Salanoubat and Belliard, *Gene.* 60:47-56 (1987), Salanoubat and Belliard, *Gene.* 84:181-185 (1989), both of which are incorporated by reference in their entirety), the promoter for the major tuber proteins including the 22 kd protein complexes and proteinase inhibitors (Hannapel, *Plant Physiol.* 101:703-704 (1993), herein incorporated by reference in its entirety), the promoter for the granule bound starch synthase gene (GBSS) (Visser *et al.*, *Plant Mol. Biol.* 17:691-699 (1991), herein incorporated by reference in its entirety) and other class I and II patatins promoters (Koster-Topfer *et al.*, *Mol Gen Genet.*

219:390-396 (1989); Mignery *et al.*, *Gene*. 62:27-44 (1988), both of which are herein incorporated by reference in their entirety).

Other promoters can also be used to express a transcription factor or fragment thereof in specific tissues, such as seeds or fruits. The promoter for β -conglycinin (Chen *et al.*, *Dev. Genet.* 10: 112-122 (1989), herein incorporated by reference in its entirety) or other seed-specific promoters such as the napin and phaseolin promoters, can be used. The zeins are a group of storage proteins found in maize endosperm. Genomic clones for zein genes have been isolated (Pedersen *et al.*, *Cell* 29:1015-1026 (1982), herein incorporated by reference in its entirety) and the promoters from these clones, including the 15 kD, 16 kD, 19 kD, 22 kD, 27 kD and γ genes, could also be used. Other promoters known to function, for example, in maize include the promoters for the following genes: *waxy*, *Brittle*, *Shrunken 2*, Branching enzymes I and II, starch synthases, debranching enzymes, oleosins, glutelins and sucrose synthases. A particularly preferred promoter for maize endosperm expression is the promoter for the glutelin gene from rice, more particularly the Osgt-1 promoter (Zheng *et al.*, *Mol. Cell Biol.* 13:5829-5842 (1993), herein incorporated by reference in its entirety). Examples of promoters suitable for expression in wheat include those promoters for the ADPglucose pyrosynthase (ADPGPP) subunits, the granule bound and other starch synthase, the branching and debranching enzymes, the embryogenesis-abundant proteins, the gliadins and the glutenins. Examples of such promoters in rice include those promoters for the ADPGPP subunits, the granule bound and other starch synthase, the branching enzymes, the debranching enzymes, sucrose synthases and the glutelins. A particularly preferred promoter is the promoter for rice glutelin, Osgt-1. Examples of such promoters for barley include those for the ADPGPP subunits, the granule bound and other starch

synthase, the branching enzymes, the debranching enzymes, sucrose synthases, the hordcins, the embryo globulins and the aleurone specific proteins.

Root specific promoters may also be used. An example of such a promoter is the promoter for the acid chitinase gene (Samac *et al.*, *Plant Mol. Biol.* 25:587-596 (1994), the entirety of which is herein incorporated by reference). Expression in root tissue could also be accomplished by utilizing the root specific subdomains of the CaMV35S promoter that have been identified (Lam *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 86:7890-7894 (1989), herein incorporated by reference in its entirety). Other root cell specific promoters include those reported by Conkling *et al.* (Conkling *et al.*, *Plant Physiol.* 93:1203-1211 (1990), the entirety of which is herein incorporated by reference).

Additional promoters that may be utilized are described, for example, in U.S. Patent Nos. 5,378,619; 5,391,725; 5,428,147; 5,447,858; 5,608,144; 5,608,144; 5,614,399; 5,633,441; 5,633,435; and 4,633,436, all of which are herein incorporated in their entirety. In addition, a tissue specific enhancer may be used (Fromm *et al.*, *The Plant Cell* 1:977-984 (1989), the entirety of which is herein incorporated by reference).

Constructs or vectors may also include with the coding region of interest a nucleic acid sequence that acts, in whole or in part, to terminate transcription of that region. For example, such sequences have been isolated including the Tr7 3' sequence and the NOS 3' sequence (Ingelbrecht *et al.*, *The Plant Cell* 1:671-680 (1989), the entirety of which is herein incorporated by reference; Bevan *et al.*, *Nucleic Acids Res.* 11:369-385 (1983), the entirety of which is herein incorporated by reference), or the like.

A vector or construct may also include regulatory elements. Examples of such include the Adh intron 1 (Callis *et al.*, *Genes and Develop.* 1:1183-1200 (1987), the entirety of which is

herein incorporated by reference), the sucrose synthase intron (Vasil *et al.*, Plant Physiol. 91:1575-1579 (1989), the entirety of which is herein incorporated by reference) and the TMV omega element (Gallie *et al.*, *The Plant Cell* 1:301-311 (1989), the entirety of which is herein incorporated by reference). These and other regulatory elements may be included when appropriate.

A vector or construct may also include a selectable marker. Selectable markers may also be used to select for plants or plant cells that contain the exogenous genetic material. Examples of such include, but are not limited to, a neo gene (Potrykus *et al.*, *Mol. Gen. Genet.* 199:183-188 (1985), the entirety of which is herein incorporated by reference) which codes for kanamycin resistance and can be selected for using kanamycin, G418, etc.; a bar gene which codes for bialaphos resistance; a mutant EPSP synthase gene (Hinchee *et al.*, *Bio/Technology* 6:915-922 (1988), the entirety of which is herein incorporated by reference) which encodes glyphosate resistance; a nitrilase gene which confers resistance to bromoxynil (Stalker *et al.*, *J. Biol. Chem.* 263:6310-6314 (1988), the entirety of which is herein incorporated by reference); a mutant acetolactate synthase gene (ALS) which confers imidazolinone or sulphonylurea resistance (European Patent Application 154,204 (Sept. 11, 1985), the entirety of which is herein incorporated by reference); and a methotrexate resistant DHFR gene (Thillet *et al.*, *J. Biol. Chem.* 263:12500-12508 (1988), the entirety of which is herein incorporated by reference).

A vector or construct may also include a transit peptide. Incorporation of a suitable chloroplast transit peptide may also be employed (European Patent Application Publication Number 0218571, the entirety of which is herein incorporated by reference). Translational enhancers may also be incorporated as part of the vector DNA. DNA constructs could contain one or more 5' non-translated leader sequences which may serve to enhance expression of the

gene products from the resulting mRNA transcripts. Such sequences may be derived from the promoter selected to express the gene or can be specifically modified to increase translation of the mRNA. Such regions may also be obtained from viral RNAs, from suitable eukaryotic genes, or from a synthetic gene sequence. For a review of optimizing expression of transgenes, see Koziel *et al.*, *Plant Mol. Biol.* 32:393-405 (1996), the entirety of which is herein incorporated by reference.

A vector or construct may also include a screenable marker. Screenable markers may be used to monitor expression. Exemplary screenable markers include a β -glucuronidase or uidA gene (GUS) which encodes an enzyme for which various chromogenic substrates are known (Jefferson, *Plant Mol. Biol. Rep.* 5:387-405 (1987), the entirety of which is herein incorporated by reference; Jefferson *et al.*, *EMBO J.* 6:3901-3907 (1987), the entirety of which is herein incorporated by reference); an R-locus gene, which encodes a product that regulates the production of anthocyanin pigments (red color) in plant tissues (Dellaporta *et al.*, *Stadler Symposium* 11:263-282 (1988), the entirety of which is herein incorporated by reference); a β -lactamase gene (Sutcliffe *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 75:3737-3741 (1978), the entirety of which is herein incorporated by reference), a gene which encodes an enzyme for which various chromogenic substrates are known (e.g., PADAC, a chromogenic cephalosporin); a luciferase gene (Ow *et al.*, *Science* 234:856-859 (1986), the entirety of which is herein incorporated by reference); a xylE gene (Zukowsky *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 80:1101-1105 (1983), the entirety of which is herein incorporated by reference) which encodes a catechol dioxygenase that can convert chromogenic catechols; an α -amylase gene (Ikata *et al.*, *Bio/Technol.* 8:241-242 (1990), the entirety of which is herein incorporated by reference); a

tyrosinase gene (Katz *et al.*, *J. Gen. Microbiol.* 129:2703-2714 (1983), the entirety of which is herein incorporated by reference) which encodes an enzyme capable of oxidizing tyrosine to DOPA and dopaquinone which in turn condenses to melanin; an α -galactosidase, which will turn a chromogenic α -galactose substrate.

Included within the terms "selectable or screenable marker genes" are also genes which encode a secretable marker whose secretion can be detected as a means of identifying or selecting for transformed cells. Examples include markers which encode a secretable antigen that can be identified by antibody interaction, or even secretable enzymes which can be detected catalytically. Secretable proteins fall into a number of classes, including small, diffusible proteins which are detectable, (*e.g.*, by ELISA), small active enzymes which are detectable in extracellular solution (*e.g.*, α -amylase, β -lactamase, phosphinothricin transferase), or proteins which are inserted or trapped in the cell wall (such as proteins which include a leader sequence such as that found in the expression unit of extension or tobacco PR-S). Other possible selectable and/or screenable marker genes will be apparent to those of skill in the art.

There are many methods for introducing transforming nucleic acid molecules into plant cells. Suitable methods are believed to include virtually any method by which nucleic acid molecules may be introduced into a cell, such as by *Agrobacterium* infection or direct delivery of nucleic acid molecules such as, for example, by PEG-mediated transformation, by electroporation or by acceleration of DNA coated particles, etc (Potrykus, *Ann. Rev. Plant Physiol. Plant Mol. Biol.* 42:205-225 (1991), the entirety of which is herein incorporated by reference; Vasil, *Plant Mol. Biol.* 25:925-937 (1994), the entirety of which is herein incorporated by reference). For example, electroporation has been used to transform maize protoplasts

(Fromm *et al.*, *Nature* 312:791-793 (1986), the entirety of which is herein incorporated by reference).

Other vector systems suitable for introducing transforming DNA into a host plant cell include but are not limited to binary artificial chromosome (BIBAC) vectors (Hamilton *et al.*, *Gene* 200:107-116 (1997), the entirety of which is herein incorporated by reference); and transfection with RNA viral vectors (Della-Cioppa *et al.*, *Ann. N.Y. Acad. Sci.* (1996), 792 (Engineering Plants for Commercial Products and Applications), 57-61, the entirety of which is herein incorporated by reference). Additional vector systems also include plant selectable YAC vectors such as those described in Mullen *et al.*, *Molecular Breeding* 4:449-457 (1988), the entirety of which is herein incorporated by reference).

Technology for introduction of DNA into cells is well known to those of skill in the art. Four general methods for delivering a gene into cells have been described: (1) chemical methods (Graham and van der Eb, *Virology* 54:536-539 (1973), the entirety of which is herein incorporated by reference); (2) physical methods such as microinjection (Capecchi, *Cell* 22:479-488 (1980), the entirety of which is herein incorporated by reference), electroporation (Wong and Neumann, *Biochem. Biophys. Res. Commun.* 107:584-587 (1982); Fromm *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 82:5824-5828 (1985); U.S. Patent No. 5,384,253, all of which are herein incorporated in their entirety); and the gene gun (Johnston and Tang, *Methods Cell Biol.* 43:353-365 (1994), the entirety of which is herein incorporated by reference); (3) viral vectors (Clapp, *Clin. Perinatol.* 20:155-168 (1993); Lu *et al.*, *J. Exp. Med.* 178:2089-2096 (1993); Eglitis and Anderson, *Biotechniques* 6:608-614 (1988), all of which are herein incorporated in their entirety); and (4) receptor-mediated mechanisms (Curiel *et al.*, *Hum. Gen. Ther.* 3:147-154

(1992), Wagner *et al.*, *Proc. Natl. Acad. Sci. (USA)* 89:6099-6103 (1992), both of which are incorporated by reference in their entirety).

Acceleration methods that may be used include, for example, microprojectile bombardment and the like. One example of a method for delivering transforming nucleic acid molecules to plant cells is microprojectile bombardment. This method has been reviewed by Yang and Christou (eds.), *Particle Bombardment Technology for Gene Transfer*, Oxford Press, Oxford, England (1994), the entirety of which is herein incorporated by reference). Non-biological particles (microprojectiles) that may be coated with nucleic acids and delivered into cells by a propelling force. Exemplary particles include those comprised of tungsten, gold, platinum and the like.

A particular advantage of microprojectile bombardment, in addition to it being an effective means of reproducibly transforming monocots, is that neither the isolation of protoplasts (Cristou *et al.*, *Plant Physiol.* 87:671-674 (1988), the entirety of which is herein incorporated by reference) nor the susceptibility of *Agrobacterium* infection are required. An illustrative embodiment of a method for delivering DNA into maize cells by acceleration is a biolistics α -particle delivery system, which can be used to propel particles coated with DNA through a screen, such as a stainless steel or Nytex screen, onto a filter surface covered with corn cells cultured in suspension. Gordon-Kamm *et al.*, describes the basic procedure for coating tungsten particles with DNA (Gordon-Kamm *et al.*, *Plant Cell* 2:603-618 (1990), the entirety of which is herein incorporated by reference). The screen disperses the tungsten nucleic acid particles so that they are not delivered to the recipient cells in large aggregates. A particle delivery system suitable for use with the present invention is the helium acceleration PDS-

1000/He gun is available from Bio-Rad Laboratories (Bio-Rad, Hercules, California)(Sanford *et al.*, *Technique* 3:3-16 (1991), the entirety of which is herein incorporated by reference).

For the bombardment, cells in suspension may be concentrated on filters. Filters containing the cells to be bombarded are positioned at an appropriate distance below the microprojectile stopping plate. If desired, one or more screens are also positioned between the gun and the cells to be bombarded.

Alternatively, immature embryos or other target cells may be arranged on solid culture medium. The cells to be bombarded are positioned at an appropriate distance below the microprojectile stopping plate. If desired, one or more screens are also positioned between the acceleration device and the cells to be bombarded. Through the use of techniques set forth herein one may obtain up to 1000 or more foci of cells transiently expressing a marker gene. The number of cells in a focus which express the exogenous gene product 48 hours post-bombardment often range from one to ten and average one to three.

In bombardment transformation, one may optimize the pre-bombardment culturing conditions and the bombardment parameters to yield the maximum numbers of stable transformants. Both the physical and biological parameters for bombardment are important in this technology. Physical factors are those that involve manipulating the DNA/microprojectile precipitate or those that affect the flight and velocity of either the macro- or microprojectiles. Biological factors include all steps involved in manipulation of cells before and immediately after bombardment, the osmotic adjustment of target cells to help alleviate the trauma associated with bombardment and also the nature of the transforming DNA, such as linearized DNA or intact supercoiled plasmids. It is believed that pre-bombardment manipulations are especially important for successful transformation of immature embryos.

In another alternative embodiment, plastids can be stably transformed. Methods disclosed for plastid transformation in higher plants include the particle gun delivery of DNA containing a selectable marker and targeting of the DNA to the plastid genome through homologous recombination (Svab *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 87:8526-8530 (1990); Svab and Maliga, *Proc. Natl. Acad. Sci. (U.S.A.)* 90:913-917 (1993); Staub and Maliga, *EMBO J.* 12:601-606 (1993); U.S. Patents 5, 451,513 and 5,545,818, all of which are herein incorporated by reference in their entirety).

Accordingly, it is contemplated that one may wish to adjust various aspects of the bombardment parameters in small scale studies to fully optimize the conditions. One may particularly wish to adjust physical parameters such as gap distance, flight distance, tissue distance and helium pressure. One may also minimize the trauma reduction factors by modifying conditions which influence the physiological state of the recipient cells and which may therefore influence transformation and integration efficiencies. For example, the osmotic state, tissue hydration and the subculture stage or cell cycle of the recipient cells may be adjusted for optimum transformation. The execution of other routine adjustments will be known to those of skill in the art in light of the present disclosure.

Agrobacterium-mediated transfer is a widely applicable system for introducing genes into plant cells because the DNA can be introduced into whole plant tissues, thereby bypassing the need for regeneration of an intact plant from a protoplast. The use of *Agrobacterium*-mediated plant integrating vectors to introduce DNA into plant cells is well known in the art. See, for example the methods described by Fraley *et al.*, *Bio/Technology* 3:629-635 (1985) and Rogers *et al.*, *Methods Enzymol.* 153:253-277 (1987), both of which are herein incorporated by reference in their entirety. Further, the integration of the Ti-DNA is a relatively precise process resulting in

few rearrangements. The region of DNA to be transferred is defined by the border sequences and intervening DNA is usually inserted into the plant genome as described (Spielmann *et al.*, *Mol. Gen. Genet.* 205:34 (1986), the entirety of which is herein incorporated by reference).

Modern *Agrobacterium* transformation vectors are capable of replication in *E. coli* as well as *Agrobacterium*, allowing for convenient manipulations as described (Klee *et al.*, In: *Plant DNA Infectious Agents*, Hohn and Schell (eds.), Springer-Verlag, New York, pp. 179-203 (1985), the entirety of which is herein incorporated by reference. Moreover, technological advances in vectors for *Agrobacterium*-mediated gene transfer have improved the arrangement of genes and restriction sites in the vectors to facilitate construction of vectors capable of expressing various polypeptide coding genes. The vectors described have convenient multi-linker regions flanked by a promoter and a polyadenylation site for direct expression of inserted polypeptide coding genes and are suitable for present purposes (Rogers *et al.*, *Methods Enzymol.* 153:253-277 (1987)). In addition, *Agrobacterium* containing both armed and disarmed Ti genes can be used for the transformations. In those plant strains where *Agrobacterium*-mediated transformation is efficient, it is the method of choice because of the facile and defined nature of the gene transfer.

A transgenic plant formed using *Agrobacterium* transformation methods typically contains a single gene on one chromosome. Such transgenic plants can be referred to as being heterozygous for the added gene. More preferred is a transgenic plant that is homozygous for the added structural gene; *i.e.*, a transgenic plant that contains two added genes, one gene at the same locus on each chromosome of a chromosome pair. A homozygous transgenic plant can be obtained by sexually mating (selfing) an independent segregant transgenic plant that contains a single added gene, germinating some of the seed produced and analyzing the resulting plants produced for the gene of interest.

It is also to be understood that two different transgenic plants can also be mated to produce offspring that contain two independently segregating added, exogenous genes. Selfing of appropriate progeny can produce plants that are homozygous for both added, exogenous genes that encode a polypeptide of interest. Back-crossing to a parental plant and out-crossing with a non-transgenic plant are also contemplated, as is vegetative propagation.

Transformation of plant protoplasts can be achieved using methods based on calcium phosphate precipitation, polyethylene glycol treatment, electroporation and combinations of these treatments (*See, for example, Potrykus et al., Mol. Gen. Genet.* 205:193-200 (1986); Lorz *et al., Mol. Gen. Genet.* 199:178 (1985); Fromm *et al., Nature* 319:791 (1986); Uchimiya *et al., Mol. Gen. Genet.* 204:204 (1986); Marcotte *et al., Nature* 335:454-457 (1988), all of which are herein incorporated by reference in their entirety).

Application of these systems to different plant strains depends upon the ability to regenerate that particular plant strain from protoplasts. Illustrative methods for the regeneration of cereals from protoplasts are described (Fujimura *et al., Plant Tissue Culture Letters* 2:74 (1985); Toriyama *et al., Theor Appl. Genet.* 205:34 (1986); Yamada *et al., Plant Cell Rep.* 4:85 (1986); Abdullah *et al., Biotechnolog* 4:1087 (1986), all of which are herein incorporated by reference in their entirety).

To transform plant strains that cannot be successfully regenerated from protoplasts, other ways to introduce DNA into intact cells or tissues can be utilized. For example, regeneration of cereals from immature embryos or explants can be effected as described (Vasil, *Biotechnology* 6:397 (1988), the entirety of which is herein incorporated by reference). In addition, "particle gun" or high-velocity microprojectile technology can be utilized (Vasil *et al., Bio/Technology* 10:667 (1992), the entirety of which is herein incorporated by reference).

Using the latter technology, DNA is carried through the cell wall and into the cytoplasm on the surface of small metal particles as described (Klein *et al.*, *Nature* 328:70 (1987); Klein *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 85:8502-8505 (1988); McCabe *et al.*, *Bio/Technology* 6:923 (1988), all of which are herein incorporated by reference in their entirety). The metal particles penetrate through several layers of cells and thus allow the transformation of cells within tissue explants.

Other methods of cell transformation can also be used and include but are not limited to introduction of DNA into plants by direct DNA transfer into pollen (Zhou *et al.*, *Methods Enzymol.* 101:433 (1983); Hess *et al.*, *Intern Rev. Cytol.* 107:367 (1987); Luo *et al.*, *Plant Mol Biol. Reporter* 6:165 (1988), all of which are herein incorporated by reference in their entirety), by direct injection of DNA into reproductive organs of a plant (Pena *et al.*, *Nature* 325:274 (1987), the entirety of which is herein incorporated by reference), or by direct injection of DNA into the cells of immature embryos followed by the rehydration of desiccated embryos (Neuhaus *et al.*, *Theor. Appl. Genet.* 75:30 (1987), the entirety of which is herein incorporated by reference).

The regeneration, development and cultivation of plants from single plant protoplast transformants or from various transformed explants is well known in the art (Weissbach and Weissbach, In: *Methods for Plant Molecular Biology*, Academic Press, San Diego, CA, (1988), the entirety of which is herein incorporated by reference). This regeneration and growth process typically includes the steps of selection of transformed cells, culturing those individualized cells through the usual stages of embryonic development through the rooted plantlet stage. Transgenic embryos and seeds are similarly regenerated. The resulting transgenic rooted shoots are thereafter planted in an appropriate plant growth medium such as soil.

The development or regeneration of plants containing the foreign, exogenous gene that encodes a protein of interest is well known in the art. Preferably, the regenerated plants are self-pollinated to provide homozygous transgenic plants. Otherwise, pollen obtained from the regenerated plants is crossed to seed-grown plants of agronomically important lines. Conversely, pollen from plants of these important lines is used to pollinate regenerated plants. A transgenic plant of the present invention containing a desired polypeptide is cultivated using methods well known to one skilled in the art.

There are a variety of methods for the regeneration of plants from plant tissue. The particular method of regeneration will depend on the starting plant tissue and the particular plant species to be regenerated.

Methods for transforming dicots, primarily by use of *Agrobacterium tumefaciens* and obtaining transgenic plants have been published for cotton (U.S. Patent No. 5,004,863; U.S. Patent No. 5,159,135; U.S. Patent No. 5,518,908, all of which are herein incorporated by reference in their entirety); soybean (U.S. Patent No. 5,569,834; U.S. Patent No. 5,416,011; McCabe *et al.*, *Biotechnology* 6:923 (1988); Christou *et al.*, *Plant Physiol.* 87:671-674 (1988); all of which are herein incorporated by reference in their entirety); *Brassica* (U.S. Patent No. 5,463,174, the entirety of which is herein incorporated by reference); peanut (Cheng *et al.*, *Plant Cell Rep.* 15:653-657 (1996), McKently *et al.*, *Plant Cell Rep.* 14:699-703 (1995), all of which are herein incorporated by reference in their entirety); papaya; and pea (Grant *et al.*, *Plant Cell Rep.* 15:254-258 (1995), the entirety of which is herein incorporated by reference).

Transformation of monocotyledons using electroporation, particle bombardment and *Agrobacterium* have also been reported. Transformation and plant regeneration have been achieved in asparagus (Bytebier *et al.*, *Proc. Natl. Acad. Sci. (USA)* 84:5354 (1987), the entirety

et al., *Cell* 66:895-905 (1991), the entirety of which is herein incorporated by reference; Hattori *et al.*, *Genes Dev.* 6:609-618 (1992), the entirety of which is herein incorporated by reference; Goff *et al.*, *EMBO J.* 9:2517-2522 (1990), the entirety of which is herein incorporated by reference). Transient expression systems may be used to functionally dissect gene constructs (see generally, Mailga *et al.*, *Methods in Plant Molecular Biology*, Cold Spring Harbor Press (1995)).

Any of the nucleic acid molecules of the present invention may be introduced into a plant cell in a permanent or transient manner in combination with other genetic elements such as vectors, promoters, enhancers etc. Further, any of the nucleic acid molecules of the present invention may be introduced into a plant cell in a manner that allows for overexpression of the protein or fragment thereof encoded by the nucleic acid molecule.

Cosuppression is the reduction in expression levels, usually at the level of RNA, of a particular endogenous gene or gene family by the expression of a homologous sense construct that is capable of transcribing mRNA of the same strandedness as the transcript of the endogenous gene (Napoli *et al.*, *Plant Cell* 2:279-289 (1990), the entirety of which is herein incorporated by reference; van der Krol *et al.*, *Plant Cell* 2:291-299 (1990), the entirety of which is herein incorporated by reference). Cosuppression may result from stable transformation with a single copy nucleic acid molecule that is homologous to a nucleic acid sequence found with the cell (Prolls and Meyer, *Plant J.* 2:465-475 (1992), the entirety of which is herein incorporated by reference) or with multiple copies of a nucleic acid molecule that is homologous to a nucleic acid sequence found with the cell (Mittlesten *et al.*, *Mol. Gen. Genet.* 244:325-330 (1994), the entirety of which is herein incorporated by reference). Genes, even though different, linked to

homologous promoters may result in the cosuppression of the linked genes (Vaucheret, *C.R. Acad. Sci. III* 316:1471-1483 (1993), the entirety of which is herein incorporated by reference).

This technique has, for example, been applied to generate white flowers from red petunia and tomatoes that do not ripen on the vine. Up to 50% of petunia transformants that contained a sense copy of the glucoamylase (CHS) gene produced white flowers or floral sectors; this was as a result of the post-transcriptional loss of mRNA encoding CHS (Flavell, *Proc. Natl. Acad. Sci. (U.S.A.)* 91:3490-3496 (1994), the entirety of which is herein incorporated by reference); van Blokland *et al.*, *Plant J.* 6:861-877 (1994), the entirety of which is herein incorporated by reference). Cosuppression may require the coordinate transcription of the transgene and the endogenous gene and can be reset by a developmental control mechanism (Jorgensen, *Trends Biotechnol.* 8:340-344 (1990), the entirety of which is herein incorporated by reference; Meins and Kunz, In: *Gene Inactivation and Homologous Recombination in Plants*, Paszkowski (ed.), pp. 335-348, Kluwer Academic, Netherlands (1994), the entirety of which is herein incorporated by reference).

It is understood that one or more of the nucleic acids of the present invention may be introduced into a plant cell and transcribed using an appropriate promoter with such transcription resulting in the cosuppression of an endogenous transcription factor.

Antisense approaches are a way of preventing or reducing gene function by targeting the genetic material (Mol *et al.*, *FEBS Lett.* 268:427-430 (1990), the entirety of which is herein incorporated by reference). The objective of the antisense approach is to use a sequence complementary to the target gene to block its expression and create a mutant cell line or organism in which the level of a single chosen protein is selectively reduced or abolished. Antisense techniques have several advantages over other 'reverse genetic' approaches. The site

of inactivation and its developmental effect can be manipulated by the choice of promoter for antisense genes or by the timing of external application or microinjection. Antisense can manipulate its specificity by selecting either unique regions of the target gene or regions where it shares homology to other related genes (Hiatt *et al.*, In: *Genetic Engineering*, Setlow (ed.), Vol. 11, New York: Plenum 49-63 (1989), the entirety of which is herein incorporated by reference).

The principle of regulation by antisense RNA is that RNA that is complementary to the target mRNA is introduced into cells, resulting in specific RNA:RNA duplexes being formed by base pairing between the antisense substrate and the target mRNA (Green *et al.*, *Annu. Rev. Biochem.* 55:569-597 (1986), the entirety of which is herein incorporated by reference). Under one embodiment, the process involves the introduction and expression of an antisense gene sequence. Such a sequence is one in which part or all of the normal gene sequences are placed under a promoter in inverted orientation so that the 'wrong' or complementary strand is transcribed into a noncoding antisense RNA that hybridizes with the target mRNA and interferes with its expression (Takayama and Inouye, *Crit. Rev. Biochem. Mol. Biol.* 25:155-184 (1990), the entirety of which is herein incorporated by reference). An antisense vector is constructed by standard procedures and introduced into cells by transformation, transfection, electroporation, microinjection, infection, etc. The type of transformation and choice of vector will determine whether expression is transient or stable. The promoter used for the antisense gene may influence the level, timing, tissue, specificity, or inducibility of the antisense inhibition.

It is understood that the activity of a transcription factor in a plant cell may be reduced or depressed by growing a transformed plant cell containing a nucleic acid molecule whose non-transcribed strand encodes a transcription factor or fragment thereof.

Antibodies have been expressed in plants (Hiatt *et al.*, *Nature* 342:76-78 (1989), the entirety of which is herein incorporated by reference; Conrad and Fielder, *Plant Mol. Biol.* 26:1023-1030 (1994), the entirety of which is herein incorporated by reference). Cytoplasmic expression of a scFv (single-chain Fv antibodies) has been reported to delay infection by artichoke mottled crinkle virus. Transgenic plants that express antibodies directed against endogenous proteins may exhibit a physiological effect (Philips *et al.*, *EMBO J.* 16:4489-4496 (1997), the entirety of which is herein incorporated by reference; Marion-Poll, *Trends in Plant Science* 2:447-448 (1997), the entirety of which is herein incorporated by reference). For example, expressed anti-abscisic antibodies have been reported to result in a general perturbation of seed development (Philips *et al.*, *EMBO J.* 16: 4489-4496 (1997)).

Antibodies that are catalytic may also be expressed in plants (abzymes). The principle behind abzymes is that since antibodies may be raised against many molecules, this recognition ability can be directed toward generating antibodies that bind transition states to force a chemical reaction forward (Persidas, *Nature Biotechnology* 15:1313-1315 (1997), the entirety of which is herein incorporated by reference; Baca *et al.*, *Ann. Rev. Biophys. Biomol. Struct.* 26:461-493 (1997), the entirety of which is herein incorporated by reference). The catalytic abilities of abzymes may be enhanced by site directed mutagenesis. Examples of abzymes are, for example, set forth in U.S. Patent No: 5,658,753; U.S. Patent No. 5,632,990; U.S. Patent No. 5,631,137; U.S. Patent 5,602,015; U.S. Patent No. 5,559,538; U.S. Patent No. 5,576,174; U.S. Patent No. 5,500,358; U.S. Patent 5,318,897; U.S. Patent No. 5,298,409; U.S. Patent No. 5,258,289 and U.S. Patent No. 5,194,585, all of which are herein incorporated in their entirety.

It is understood that any of the antibodies of the present invention may be expressed in plants and that such expression can result in a physiological effect. It is also understood that any of the expressed antibodies may be catalytic.

(b) Fungal Constructs and Fungal Transformants

The present invention also relates to a fungal recombinant vector comprising exogenous genetic material. The present invention also relates to a fungal cell comprising a fungal recombinant vector. The present invention also relates to methods for obtaining a recombinant fungal host cell comprising introducing into a fungal host cell exogenous genetic material.

Exogenous genetic material may be transferred into a fungal cell. In a preferred embodiment the exogenous genetic material includes a nucleic acid molecule of the present invention having a sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof or fragments of either or other nucleic acid molecule of the present invention. The fungal recombinant vector may be any vector which can be conveniently subjected to recombinant DNA procedures. The choice of a vector will typically depend on the compatibility of the vector with the fungal host cell into which the vector is to be introduced. The vector may be a linear or a closed circular plasmid. The vector system may be a single vector or plasmid or two or more vectors or plasmids which together contain the total DNA to be introduced into the genome of the fungal host.

The fungal vector may be an autonomously replicating vector, *i.e.*, a vector which exists as an extrachromosomal entity, the replication of which is independent of chromosomal replication, *e.g.*, a plasmid, an extrachromosomal element, a minichromosome, or an artificial chromosome. The vector may contain any means for assuring self-replication. Alternatively, the vector may be one which, when introduced into the fungal cell, is integrated into the genome and

replicated together with the chromosome(s) into which it has been integrated. For integration, the vector may rely on the nucleic acid sequence of the vector for stable integration of the vector into the genome by homologous or nonhomologous recombination. Alternatively, the vector may contain additional nucleic acid sequences for directing integration by homologous recombination into the genome of the fungal host. The additional nucleic acid sequences enable the vector to be integrated into the host cell genome at a precise location(s) in the chromosome(s). To increase the likelihood of integration at a precise location, there should be preferably two nucleic acid sequences which individually contain a sufficient number of nucleic acids, preferably 400bp to 1500bp, more preferably 800bp to 1000bp, which are highly homologous with the corresponding target sequence to enhance the probability of homologous recombination. These nucleic acid sequences may be any sequence that is homologous with a target sequence in the genome of the fungal host cell and, furthermore, may be non-encoding or encoding sequences.

For autonomous replication, the vector may further comprise an origin of replication enabling the vector to replicate autonomously in the host cell in question. Examples of origin of replications for use in a yeast host cell are the 2 micron origin of replication and the combination of CEN3 and ARS 1. Any origin of replication may be used which is compatible with the fungal host cell of choice.

The fungal vectors of the present invention preferably contain one or more selectable markers which permit easy selection of transformed cells. A selectable marker is a gene the product of which provides, for example biocide or viral resistance, resistance to heavy metals, prototrophy to auxotrophs and the like. The selectable marker may be selected from the group including, but not limited to, *amdS* (acetamidase), *argB* (ornithine carbamoyltransferase), *bar*

(phosphinothricin acetyltransferase), *hygB* (hygroscopicin phosphotransferase), *niaD* (nitrate reductase), *pyrG* (orotidine-5'-phosphate decarboxylase) and *sC* (sulfate adenylyltransferase) and *trpC* (anthranilate synthase). Preferred for use in an *Aspergillus* cell are the *amdS* and *pyrG* markers of *Aspergillus nidulans* or *Aspergillus oryzae* and the *bar* marker of *Streptomyces hygroscopicus*. Furthermore, selection may be accomplished by co-transformation, *e.g.*, as described in WO 91/17243, the entirety of which is herein incorporated by reference. A nucleic acid sequence of the present invention may be operably linked to a suitable promoter sequence. The promoter sequence is a nucleic acid sequence which is recognized by the fungal host cell for expression of the nucleic acid sequence. The promoter sequence contains transcription and translation control sequences which mediate the expression of the protein or fragment thereof.

A promoter may be any nucleic acid sequence which shows transcriptional activity in the fungal host cell of choice and may be obtained from genes encoding polypeptides either homologous or heterologous to the host cell. Examples of suitable promoters for directing the transcription of a nucleic acid construct of the invention in a filamentous fungal host are promoters obtained from the genes encoding *Aspergillus oryzae* TKA amylose, *Rhizomucor miehei* aspartic proteinase, *Aspergillus niger* neutral alpha-amylose, *Aspergillus niger* acid stable alpha-amylose, *Aspergillus niger* or *Aspergillus awamori* glucoamylose (glaA), *Rhizomucor miehei* lipase, *Aspergillus oryzae* alkaline protease, *Aspergillus oryzae* triose phosphate isomerase, *Aspergillus nidulans* acetamidase and hybrids thereof. In a yeast host, a useful promoter is the *Saccharomyces cerevisiae* enolase (eno-1) promoter. Particularly preferred promoters are the TKA amylose, NA2-tpi (a hybrid of the promoters from the genes encoding *Aspergillus niger* neutral alpha -amylose and *Aspergillus oryzae* triose phosphate isomerase) and glaA promoters.

A protein or fragment thereof encoding nucleic acid molecule of the present invention may also be operably linked to a terminator sequence at its 3' terminus. The terminator sequence may be native to the nucleic acid sequence encoding the protein or fragment thereof or may be obtained from foreign sources. Any terminator which is functional in the fungal host cell of choice may be used in the present invention, but particularly preferred terminators are obtained from the genes encoding *Aspergillus oryzae* TAKA amylase, *Aspergillus niger* glucoamylase, *Aspergillus nidulans* anthranilate synthase, *Aspergillus niger* alpha-glucosidase and *Saccharomyces cerevisiae* enolase.

A protein or fragment thereof encoding nucleic acid molecule of the present invention may also be operably linked to a suitable leader sequence. A leader sequence is a nontranslated region of a mRNA which is important for translation by the fungal host. The leader sequence is operably linked to the 5' terminus of the nucleic acid sequence encoding the protein or fragment thereof. The leader sequence may be native to the nucleic acid sequence encoding the protein or fragment thereof or may be obtained from foreign sources. Any leader sequence which is functional in the fungal host cell of choice may be used in the present invention, but particularly preferred leaders are obtained from the genes encoding *Aspergillus oryzae* TAKA amylase and *Aspergillus oryzae* triose phosphate isomerase.

A polyadenylation sequence may also be operably linked to the 3' terminus of the nucleic acid sequence of the present invention. The polyadenylation sequence is a sequence which when transcribed is recognized by the fungal host to add polyadenosine residues to transcribed mRNA. The polyadenylation sequence may be native to the nucleic acid sequence encoding the protein or fragment thereof or may be obtained from foreign sources. Any polyadenylation sequence which is functional in the fungal host of choice may be used in the present invention, but particularly

preferred polyadenylation sequences are obtained from the genes encoding *Aspergillus oryzae* TKA amylase, *Aspergillus niger* glucoamylase, *Aspergillus nidulans* anthranilate synthase and *Aspergillus niger* alpha-glucosidase.

To avoid the necessity of disrupting the cell to obtain the protein or fragment thereof and to minimize the amount of possible degradation of the expressed protein or fragment thereof within the cell, it is preferred that expression of the protein or fragment thereof gives rise to a product secreted outside the cell. To this end, a protein or fragment thereof of the present invention may be linked to a signal peptide linked to the amino terminus of the protein or fragment thereof. A signal peptide is an amino acid sequence which permits the secretion of the protein or fragment thereof from the fungal host into the culture medium. The signal peptide may be native to the protein or fragment thereof of the invention or may be obtained from foreign sources. The 5' end of the coding sequence of the nucleic acid sequence of the present invention may inherently contain a signal peptide coding region naturally linked in translation reading frame with the segment of the coding region which encodes the secreted protein or fragment thereof. Alternatively, the 5' end of the coding sequence may contain a signal peptide coding region which is foreign to that portion of the coding sequence which encodes the secreted protein or fragment thereof. The foreign signal peptide may be required where the coding sequence does not normally contain a signal peptide coding region. Alternatively, the foreign signal peptide may simply replace the natural signal peptide to obtain enhanced secretion of the desired protein or fragment thereof. The foreign signal peptide coding region may be obtained from a glucoamylase or an amylase gene from an *Aspergillus* species, a lipase or proteinase gene from *Rhizomucor miehei*, the gene for the alpha-factor from *Saccharomyces cerevisiae*, or the calf preprochymosin gene. An effective signal peptide for fungal host cells is the *Aspergillus*

oryzae TAKA amylase signal, *Aspergillus niger* neutral amylase signal, the *Rhizomucor miehei* aspartic proteinase signal, the *Humicola lanuginosus* cellulase signal, or the *Rhizomucor miehei* lipase signal. However, any signal peptide capable of permitting secretion of the protein or fragment thereof in a fungal host of choice may be used in the present invention.

A protein or fragment thereof encoding nucleic acid molecule of the present invention may also be linked to a propeptide coding region. A propeptide is an amino acid sequence found at the amino terminus of a proprotein or proenzyme. Cleavage of the propeptide from the proprotein yields a mature biochemically active protein. The resulting polypeptide is known as a propolypeptide or proenzyme (or a zymogen in some cases). Propolypeptides are generally inactive and can be converted to mature active polypeptides by catalytic or autocatalytic cleavage of the propeptide from the propolypeptide or proenzyme. The propeptide coding region may be native to the protein or fragment thereof or may be obtained from foreign sources. The foreign propeptide coding region may be obtained from the *Saccharomyces cerevisiae* alpha-factor gene or *Myceliophthora thermophila* laccase gene (WO 95/33836, the entirety of which is herein incorporated by reference).

The procedures used to ligate the elements described above to construct the recombinant expression vector of the present invention are well known to one skilled in the art (see, for example, Sambrook *et al.*, *Molecular Cloning, A Laboratory Manual*, 2nd ed., Cold Spring Harbor, N.Y., (1989)).

The present invention also relates to recombinant fungal host cells produced by the methods of the present invention which are advantageously used with the recombinant vector of the present invention. The cell is preferably transformed with a vector comprising a nucleic acid sequence of the invention followed by integration of the vector into the host chromosome. The



choice of fungal host cells will to a large extent depend upon the gene encoding the protein or fragment thereof and its source. The fungal host cell may, for example, be a yeast cell or a filamentous fungal cell.

"Yeast" as used herein includes *Ascosporogenous* yeast (*Endomycetales*), *Basidiosporogenous* yeast and yeast belonging to the *Fungi Imperfecti* (*Blastomycetes*). The *Ascosporogenous* yeasts are divided into the families *Spermophthoraceae* and *Saccharomycetaceae*. The latter is comprised of four subfamilies, *Schizosaccharomycoideae* (for example, genus *Schizosaccharomyces*), *Nadsonioideae*, *Lipomycoideae* and *Saccharomycoideae* (for example, genera *Pichia*, *Kluyveromyces* and *Saccharomyces*). The *Basidiosporogenous* yeasts include the genera *Leucosporidim*, *Rhodosporidium*, *Sporidiobolus*, *Filobasidium* and *Filobasidiella*. Yeast belonging to the *Fungi Imperfecti* are divided into two families, *Sporobolomycetaceae* (for example, genera *Sorobolomyces* and *Bullera*) and *Cryptococcaceae* (for example, genus *Candida*). Since the classification of yeast may change in the future, for the purposes of this invention, yeast shall be defined as described in Biology and Activities of Yeast (Skinner *et al.*, *Soc. App. Bacteriol. Symposium Series* No. 9, (1980), the entirety of which is herein incorporated by reference). The biology of yeast and manipulation of yeast genetics are well known in the art (*see*, for example, *Biochemistry and Genetics of Yeast*, Bacil *et al.* (ed.), 2nd edition, 1987; *The Yeasts*, Rose and Harrison (eds.), 2nd ed., (1987); and *The Molecular Biology of the Yeast Saccharomyces*, Strathern *et al.* (eds.), (1981), all of which are herein incorporated by reference in their entirety).

"Fungi" as used herein includes the phyla *Ascomycota*, *Basidiomycota*, *Chytridiomycota* and *Zygomycota* (as defined by Hawksworth *et al.*, In: Ainsworth and Bisby's *Dictionary of The Fungi*, 8th edition, 1995, CAB International, University Press, Cambridge, UK; the entirety of

which is herein incorporated by reference) as well as the *Oomycota* (as cited in Hawksworth *et al.*, In: Ainsworth and Bisby's *Dictionary of The Fungi*, 8th edition, 1995, CAB International, University Press, Cambridge, UK) and all mitosporic fungi (Hawksworth *et al.*, In: Ainsworth and Bisby's *Dictionary of The Fungi*, 8th edition, 1995, CAB International, University Press, Cambridge, UK). Representative groups of *Ascomycota* include, for example, *Neurospora*, *Eupenicillium* (= *Penicillium*), *Emericella* (= *Aspergillus*), *Eurotium* (= *Aspergillus*) and the true yeasts listed above. Examples of *Basidiomycota* include mushrooms, rusts and smuts. Representative groups of *Chytridiomycota* include, for example, *Allomyces*, *Blastocladiella*, *Coelomomyces* and aquatic fungi. Representative groups of *Oomycota* include, for example, *Saprolegniomycetous* aquatic fungi (water molds) such as *Achlya*. Examples of mitosporic fungi include *Aspergillus*, *Penicillium*, *Candida* and *Alternaria*. Representative groups of *Zygomycota* include, for example, *Rhizopus* and *Mucor*.

"Filamentous fungi" include all filamentous forms of the subdivision *Eumycota* and *Oomycota* (as defined by Hawksworth *et al.*, In: Ainsworth and Bisby's *Dictionary of The Fungi*, 8th edition, 1995, CAB International, University Press, Cambridge, UK). The filamentous fungi are characterized by a vegetative mycelium composed of chitin, cellulose, glucan, chitosan, mannan and other complex polysaccharides. Vegetative growth is by hyphal elongation and carbon catabolism is obligately aerobic. In contrast, vegetative growth by yeasts such as *Saccharomyces cerevisiae* is by budding of a unicellular thallus and carbon catabolism may be fermentative.

In one embodiment, the fungal host cell is a yeast cell. In a preferred embodiment, the yeast host cell is a cell of the species of *Candida*, *Kluyveromyces*, *Saccharomyces*, *Schizosaccharomyces*, *Pichia* and *Yarrowia*. In a preferred embodiment, the yeast host cell is a

Saccharomyces cerevisiae cell, a *Saccharomyces carlsbergensis*, *Saccharomyces diastaticus* cell, a *Saccharomyces douglasii* cell, a *Saccharomyces kluyveri* cell, a *Saccharomyces norbensis* cell, or a *Saccharomyces oviformis* cell. In another preferred embodiment, the yeast host cell is a *Kluyveromyces lactis* cell. In another preferred embodiment, the yeast host cell is a *Yarrowia lipolytica* cell.

In another embodiment, the fungal host cell is a filamentous fungal cell. In a preferred embodiment, the filamentous fungal host cell is a cell of the species of, but not limited to, *Acremonium*, *Aspergillus*, *Fusarium*, *Humicola*, *Myceliophthora*, *Mucor*, *Neurospora*, *Penicillium*, *Thielavia*, *Tolypocladium* and *Trichoderma*. In a preferred embodiment, the filamentous fungal host cell is an *Aspergillus* cell. In another preferred embodiment, the filamentous fungal host cell is an *Acremonium* cell. In another preferred embodiment, the filamentous fungal host cell is a *Fusarium* cell. In another preferred embodiment, the filamentous fungal host cell is a *Humicola* cell. In another preferred embodiment, the filamentous fungal host cell is a *Myceliophthora* cell. In another even preferred embodiment, the filamentous fungal host cell is a *Mucor* cell. In another preferred embodiment, the filamentous fungal host cell is a *Neurospora* cell. In another preferred embodiment, the filamentous fungal host cell is a *Penicillium* cell. In another preferred embodiment, the filamentous fungal host cell is a *Thielavia* cell. In another preferred embodiment, the filamentous fungal host cell is a *Tolypocladium* cell. In another preferred embodiment, the filamentous fungal host cell is a *Trichoderma* cell. In a preferred embodiment, the filamentous fungal host cell is an *Aspergillus oryzae* cell, an *Aspergillus niger* cell, an *Aspergillus foetidus* cell, or an *Aspergillus japonicus* cell. In another preferred embodiment, the filamentous fungal host cell is a *Fusarium oxysporum* cell or a *Fusarium graminearum* cell. In another preferred embodiment, the filamentous fungal

host cell is a *Humicola insolens* cell or a *Humicola lanuginosus* cell. In another preferred embodiment, the filamentous fungal host cell is a *Myceliophthora thermophila* cell. In a most preferred embodiment, the filamentous fungal host cell is a *Mucor miehei* cell. In a most preferred embodiment, the filamentous fungal host cell is a *Neurospora crassa* cell. In a most preferred embodiment, the filamentous fungal host cell is a *Penicillium purpurogenum* cell. In another most preferred embodiment, the filamentous fungal host cell is a *Thielavia terrestris* cell. In another most preferred embodiment, the *Trichoderma* cell is a *Trichoderma reesei* cell, a *Trichoderma viride* cell, a *Trichoderma longibrachiatum* cell, a *Trichoderma harzianum* cell, or a *Trichoderma koningii* cell. In a preferred embodiment, the fungal host cell is selected from an *A. nidulans* cell, an *A. niger* cell, an *A. oryzae* cell and an *A. sojae* cell. In a further preferred embodiment, the fungal host cell is an *A. nidulans* cell.

The recombinant fungal host cells of the present invention may further comprise one or more sequences which encode one or more factors that are advantageous in the expression of the protein or fragment thereof, for example, an activator (e.g., a trans-acting factor), a chaperone and a processing protease. The nucleic acids encoding one or more of these factors are preferably not operably linked to the nucleic acid encoding the protein or fragment thereof. An activator is a protein which activates transcription of a nucleic acid sequence encoding a polypeptide (Kudla *et al.*, *EMBO* 9:1355-1364(1990); Jarai and Buxton, *Current Genetics* 26:2238-244(1994); Verdier, *Yeast* 6:271-297(1990), all of which are herein incorporated by reference in their entirety). The nucleic acid sequence encoding an activator may be obtained from the genes encoding *Saccharomyces cerevisiae* heme activator protein 1 (hap1), *Saccharomyces cerevisiae* galactose metabolizing protein 4 (gal4) and *Aspergillus nidulans* ammonia regulation protein (areA). For further examples, see Verdier, *Yeast* 6:271-297 (1990);

MacKenzie *et al.*, *Journal of Gen. Microbiol.* 139:2295-2307 (1993), both of which are herein incorporated by reference in their entirety). A chaperone is a protein which assists another protein in folding properly (Hartl *et al.*, *TIBS* 19:20-25 (1994); Bergeron *et al.*, *TIBS* 19:124-128 (1994); Demolder *et al.*, *J. Biotechnology* 32:179-189 (1994); Craig, *Science* 260:1902-1903(1993); Gething and Sambrook, *Nature* 355:33-45 (1992); Puig and Gilbert, *J Biol. Chem.* 269:7764-7771 (1994); Wang and Tsou, *FASEB Journal* 7:1515-11157 (1993); Robinson *et al.*, *Bio/Technology* 1:381-384 (1994), all of which are herein incorporated by reference in their entirety). The nucleic acid sequence encoding a chaperone may be obtained from the genes encoding *Aspergillus oryzae* protein disulphide isomerase, *Saccharomyces cerevisiae* calnexin, *Saccharomyces cerevisiae* BiP/GRP78 and *Saccharomyces cerevisiae* Hsp70. For further examples, see Gething and Sambrook, *Nature* 355:33-45 (1992); Hartl *et al.*, *TIBS* 19:20-25 (1994). A processing protease is a protease that cleaves a propeptide to generate a mature biochemically active polypeptide (Enderlin and Ogrydziak, *Yeast* 10:67-79 (1994); Fuller *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 86:1434-1438 (1989); Julius *et al.*, *Cell* 37:1075-1089 (1984); Julius *et al.*, *Cell* 32:839-852 (1983), all of which are incorporated by reference in their entirety). The nucleic acid sequence encoding a processing protease may be obtained from the genes encoding *Aspergillus niger* Kex2, *Saccharomyces cerevisiae* dipeptidylaminopeptidase, *Saccharomyces cerevisiae* Kex2 and *Yarrowia lipolytica* dibasic processing endoprotease (xpr6). Any factor that is functional in the fungal host cell of choice may be used in the present invention.

Fungal cells may be transformed by a process involving protoplast formation, transformation of the protoplasts and regeneration of the cell wall in a manner known per se. Suitable procedures for transformation of *Aspergillus* host cells are described in EP 238 023 and

Yelton *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 81:1479-1474 (1984), both of which are herein incorporated by reference in their entirety. A suitable method of transforming *Fusarium* species is described by Malardier *et al.*, *Gene* 78:147-156 (1989), the entirety of which is herein incorporated by reference. Yeast may be transformed using the procedures described by Becker and Guarente, In: Abelson and Simon, (eds.), *Guide to Yeast Genetics and Molecular Biology, Methods Enzymol.* Volume 194, pp 182-187, Academic Press, Inc., New York; Ito *et al.*, *J. Bacteriology* 153:163 (1983); Hinnen *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 75:1920 (1978), all of which are herein incorporated by reference in their entirety.

The present invention also relates to methods of producing the protein or fragment thereof comprising culturing the recombinant fungal host cells under conditions conducive for expression of the protein or fragment thereof. The fungal cells of the present invention are cultivated in a nutrient medium suitable for production of the protein or fragment thereof using methods known in the art. For example, the cell may be cultivated by shake flask cultivation, small-scale or large-scale fermentation (including continuous, batch, fed-batch, or solid state fermentations) in laboratory or industrial fermentors performed in a suitable medium and under conditions allowing the protein or fragment thereof to be expressed and/or isolated. The cultivation takes place in a suitable nutrient medium comprising carbon and nitrogen sources and inorganic salts, using procedures known in the art (*see, e.g.*, Bennett and LaSure (eds.), *More Gene Manipulations in Fungi*, Academic Press, CA, (1991), the entirety of which is herein incorporated by reference). Suitable media are available from commercial suppliers or may be prepared according to published compositions (*e.g.*, in catalogues of the American Type Culture Collection, Manassas, VA). If the protein or fragment thereof is secreted into the nutrient

medium, a protein or fragment thereof can be recovered directly from the medium. If the protein or fragment thereof is not secreted, it is recovered from cell lysates.

The expressed protein or fragment thereof may be detected using methods known in the art that are specific for the particular protein or fragment. These detection methods may include the use of specific antibodies, formation of an enzyme product, or disappearance of an enzyme substrate. For example, if the protein or fragment thereof has enzymatic activity, an enzyme assay may be used. Alternatively, if polyclonal or monoclonal antibodies specific to the protein or fragment thereof are available, immunoassays may be employed using the antibodies to the protein or fragment thereof. The techniques of enzyme assay and immunoassay are well known to those skilled in the art.

The resulting protein or fragment thereof may be recovered by methods known in the arts. For example, the protein or fragment thereof may be recovered from the nutrient medium by conventional procedures including, but not limited to, centrifugation, filtration, extraction, spray-drying, evaporation, or precipitation. The recovered protein or fragment thereof may then be further purified by a variety of chromatographic procedures, e.g., ion exchange chromatography, gel filtration chromatography, affinity chromatography, or the like.

(c) Mammalian Constructs and Transformed Mammalian Cells

The present invention also relates to methods for obtaining a recombinant mammalian host cell, comprising introducing into a mammalian host cell exogenous genetic material. The present invention also relates to a mammalian cell comprising a mammalian recombinant vector. The present invention also relates to methods for obtaining a recombinant mammalian host cell, comprising introducing into a mammalian cell exogenous genetic material. In a preferred embodiment the exogenous genetic material includes a nucleic acid molecule of the present

invention having a sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof or fragments of either or other nucleic acid molecule of the present invention.

Mammalian cell lines available as hosts for expression are known in the art and include many immortalized cell lines available from the American Type Culture Collection (ATCC, Manassas, VA), such as HeLa cells, Chinese hamster ovary (CHO) cells, baby hamster kidney (BHK) cells and a number of other cell lines. Suitable promoters for mammalian cells are also known in the art and include viral promoters such as that from Simian Virus 40 (SV40) (Fiers *et al.*, *Nature* 273:113 (1978), the entirety of which is herein incorporated by reference), Rous sarcoma virus (RSV), adenovirus (ADV) and bovine papilloma virus (BPV). Mammalian cells may also require terminator sequences and poly-A addition sequences. Enhancer sequences which increase expression may also be included and sequences which promote amplification of the gene may also be desirable (for example methotrexate resistance genes).

Vectors suitable for replication in mammalian cells may include viral replicons, or sequences which insure integration of the appropriate sequences encoding HCV epitopes into the host genome. For example, another vector used to express foreign DNA is vaccinia virus. In this case, for example, a nucleic acid molecule encoding a protein or fragment thereof is inserted into the vaccinia genome. Techniques for the insertion of foreign DNA into the vaccinia virus genome are known in the art and may utilize, for example, homologous recombination. Such heterologous DNA is generally inserted into a gene which is non-essential to the virus, for example, the thymidine kinase gene (tk), which also provides a selectable marker. Plasmid vectors that greatly facilitate the construction of recombinant viruses have been described (*see*, for example, Mackett *et al.*, *J Virol.* 49:857 (1984); Chakrabarti *et al.*, *Mol. Cell. Biol.* 5:3403

(1985); Moss, In: *Gene Transfer Vectors For Mammalian Cells* (Miller and Calos, eds., Cold Spring Harbor Laboratory, N.Y., p. 10, (1987); all of which are herein incorporated by reference in their entirety). Expression of the HCV polypeptide then occurs in cells or animals which are infected with the live recombinant vaccinia virus.

The sequence to be integrated into the mammalian sequence may be introduced into the primary host by any convenient means, which includes calcium precipitated DNA, spheroplast fusion, transformation, electroporation, biolistics, lipofection, microinjection, or other convenient means. Where an amplifiable gene is being employed, the amplifiable gene may serve as the selection marker for selecting hosts into which the amplifiable gene has been introduced. Alternatively, one may include with the amplifiable gene another marker, such as a drug resistance marker, e.g. neomycin resistance (G418 in mammalian cells), hygromycin in resistance etc., or an auxotrophy marker (HIS3, TRP1, LEU2, URA3, ADE2, LYS2, etc.) for use in yeast cells.

Depending upon the nature of the modification and associated targeting construct, various techniques may be employed for identifying targeted integration. Conveniently, the DNA may be digested with one or more restriction enzymes and the fragments probed with an appropriate DNA fragment which will identify the properly sized restriction fragment associated with integration.

One may use different promoter sequences, enhancer sequences, or other sequence which will allow for enhanced levels of expression in the expression host. Thus, one may combine an enhancer from one source, a promoter region from another source, a 5'- noncoding region upstream from the initiation methionine from the same or different source as the other sequences and the like. One may provide for an intron in the non-coding region with appropriate splice

sites or for an alternative 3'- untranslated sequence or polyadenylation site. Depending upon the particular purpose of the modification, any of these sequences may be introduced, as desired.

Where selection is intended, the sequence to be integrated will have with it a marker gene, which allows for selection. The marker gene may conveniently be downstream from the target gene and may include resistance to a cytotoxic agent, e.g. antibiotics, heavy metals, or the like, resistance or susceptibility to HAT, gancyclovir, etc., complementation to an auxotrophic host, particularly by using an auxotrophic yeast as the host for the subject manipulations, or the like. The marker gene may also be on a separate DNA molecule, particularly with primary mammalian cells. Alternatively, one may screen the various transformants, due to the high efficiency of recombination in yeast, by using hybridization analysis, PCR, sequencing, or the like.

For homologous recombination, constructs can be prepared where the amplifiable gene will be flanked, normally on both sides with DNA homologous with the DNA of the target region. Depending upon the nature of the integrating DNA and the purpose of the integration, the homologous DNA will generally be within 100kb, usually 50kb, preferably about 25kb, of the transcribed region of the target gene, more preferably within 2kb of the target gene. Where modeling of the gene is intended, homology will usually be present proximal to the site of the mutation. The homologous DNA may include the 5'-upstream region outside of the transcriptional regulatory region or comprising any enhancer sequences, transcriptional initiation sequences, adjacent sequences, or the like. The homologous region may include a portion of the coding region, where the coding region may be comprised only of an open reading frame or combination of exons and introns. The homologous region may comprise all or a portion of an intron, where all or a portion of one or more exons may also be present. Alternatively, the

homologous region may comprise the 3'-region, so as to comprise all or a portion of the transcriptional termination region, or the region 3' of this region. The homologous regions may extend over all or a portion of the target gene or be outside the target gene comprising all or a portion of the transcriptional regulatory regions and/or the structural gene.

The integrating constructs may be prepared in accordance with conventional ways, where sequences may be synthesized, isolated from natural sources, manipulated, cloned, ligated, subjected to in vitro mutagenesis, primer repair, or the like. At various stages, the joined sequences may be cloned and analyzed by restriction analysis, sequencing, or the like. Usually during the preparation of a construct where various fragments are joined, the fragments, intermediate constructs and constructs will be carried on a cloning vector comprising a replication system functional in a prokaryotic host, e.g., *E. coli* and a marker for selection, e.g., biocide resistance, complementation to an auxotrophic host, etc. Other functional sequences may also be present, such as polylinkers, for ease of introduction and excision of the construct or portions thereof, or the like. A large number of cloning vectors are available such as pBR322, the pUC series, etc. These constructs may then be used for integration into the primary mammalian host.

In the case of the primary mammalian host, a replicating vector may be used. Usually, such vector will have a viral replication system, such as SV40, bovine papilloma virus, adenovirus, or the like. The linear DNA sequence vector may also have a selectable marker for identifying transfected cells. Selectable markers include the neo gene, allowing for selection with G418, the herpes tk gene for selection with HAT medium, the gpt gene with mycophenolic acid, complementation of an auxotrophic host, etc.

The vector may or may not be capable of stable maintenance in the host. Where the vector is capable of stable maintenance, the cells will be screened for homologous integration of the vector into the genome of the host, where various techniques for curing the cells may be employed. Where the vector is not capable of stable maintenance, for example, where a temperature sensitive replication system is employed, one may change the temperature from the permissive temperature to the non-permissive temperature, so that the cells may be cured of the vector. In this case, only those cells having integration of the construct comprising the amplifiable gene and, when present, the selectable marker, will be able to survive selection.

Where a selectable marker is present, one may select for the presence of the targeting construct by means of the selectable marker. Where the selectable marker is not present, one may select for the presence of the construct by the amplifiable gene. For the neo gene or the herpes tk gene, one could employ a medium for growth of the transformants of about 0.1-1 mg/ml of G418 or may use HAT medium, respectively. Where DHFR is the amplifiable gene, the selective medium may include from about 0.01-0.5 μ M of methotrexate or be deficient in glycine-hypoxanthine-thymidine and have dialysed serum (GHT media).

The DNA can be introduced into the expression host by a variety of techniques that include calcium phosphate/DNA co-precipitates, microinjection of DNA into the nucleus, electroporation, yeast protoplast fusion with intact cells, transfection, polycations, e.g., polybrene, polyornithine, etc., or the like. The DNA may be single or double stranded DNA, linear or circular. The various techniques for transforming mammalian cells are well known (see Keown *et al.*, *Methods Enzymol.* (1989); Keown *et al.*, *Methods Enzymol.* 185:527-537 (1990); Mansour *et al.*, *Nature* 336:348-352, (1988); all of which are herein incorporated by reference in their entirety).

(d) Insect Constructs and Transformed Insect Cells

The present invention also relates to an insect recombinant vectors comprising exogenous genetic material. The present invention also relates to an insect cell comprising an insect recombinant vector. The present invention also relates to methods for obtaining a recombinant insect host cell, comprising introducing into an insect cell exogenous genetic material. In a preferred embodiment the exogenous genetic material includes a nucleic acid molecule of the present invention having a sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof or fragments of either or other nucleic acid molecule of the present invention.

The insect recombinant vector may be any vector which can be conveniently subjected to recombinant DNA procedures and can bring about the expression of the nucleic acid sequence. The choice of a vector will typically depend on the compatibility of the vector with the insect host cell into which the vector is to be introduced. The vector may be a linear or a closed circular plasmid. The vector system may be a single vector or plasmid or two or more vectors or plasmids which together contain the total DNA to be introduced into the genome of the insect host. In addition, the insect vector may be an expression vector. Nucleic acid molecules can be suitably inserted into a replication vector for expression in the insect cell under a suitable promoter for insect cells. Many vectors are available for this purpose and selection of the appropriate vector will depend mainly on the size of the nucleic acid molecule to be inserted into the vector and the particular host cell to be transformed with the vector. Each vector contains various components depending on its function (amplification of DNA or expression of DNA) and the particular host cell with which it is compatible. The vector components for insect cell

transformation generally include, but are not limited to, one or more of the following: a signal sequence, origin of replication, one or more marker genes and an inducible promoter.

The insect vector may be an autonomously replicating vector, *i.e.*, a vector which exists as an extrachromosomal entity, the replication of which is independent of chromosomal replication, *e.g.*, a plasmid, an extrachromosomal element, a minichromosome, or an artificial chromosome. The vector may contain any means for assuring self-replication. Alternatively, the vector may be one which, when introduced into the insect cell, is integrated into the genome and replicated together with the chromosome(s) into which it has been integrated. For integration, the vector may rely on the nucleic acid sequence of the vector for stable integration of the vector into the genome by homologous or nonhomologous recombination. Alternatively, the vector may contain additional nucleic acid sequences for directing integration by homologous recombination into the genome of the insect host. The additional nucleic acid sequences enable the vector to be integrated into the host cell genome at a precise location(s) in the chromosome(s). To increase the likelihood of integration at a precise location, there should be preferably two nucleic acid sequences which individually contain a sufficient number of nucleic acids, preferably 400bp to 1500bp, more preferably 800bp to 1000bp, which are highly homologous with the corresponding target sequence to enhance the probability of homologous recombination. These nucleic acid sequences may be any sequence that is homologous with a target sequence in the genome of the insect host cell and, furthermore, may be non-encoding or encoding sequences.

Baculovirus expression vectors (BEVs) have become important tools for the expression of foreign genes, both for basic research and for the production of proteins with direct clinical applications in human and veterinary medicine (Doerfler, *Curr. Top. Microbiol. Immunol.*

131:51-68 (1968); Luckow and Summers, *Bio/Technology* 6:47-55 (1988a); Miller, *Annual Review of Microbiol.* 42:177-199 (1988); Summers, *Curr. Comm. Molecular Biology*, Cold Spring Harbor Press, Cold Spring Harbor, N.Y. (1988); all of which are herein incorporated by reference in their entirety). BEVs are recombinant insect viruses in which the coding sequence for a chosen foreign gene has been inserted behind a baculovirus promoter in place of the viral gene, e.g., polyhedrin (Smith and Summers, U.S. Pat. No., 4,745,051, the entirety of which is incorporated herein by reference).

The use of baculovirus vectors relies upon the host cells being derived from *Lepidopteran* insects such as *Spodoptera frugiperda* or *Trichoplusia ni*. The preferred *Spodoptera frugiperda* cell line is the cell line Sf9. The *Spodoptera frugiperda* Sf9 cell line was obtained from American Type Culture Collection (Manassas, VA.) and is assigned accession number ATCC CRL 1711 (Summers and Smith, *A Manual of Methods for Baculovirus Vectors and Insect Cell Culture Procedures*, Texas Ag. Exper. Station Bulletin No. 1555 (1988), the entirety of which is herein incorporated by reference). Other insect cell systems, such as the silkworm *B. mori* may also be used.

The proteins expressed by the BEVs are, therefore, synthesized, modified and transported in host cells derived from *Lepidopteran* insects. Most of the genes that have been inserted and produced in the baculovirus expression vector system have been derived from vertebrate species. Other baculovirus genes in addition to the polyhedrin promoter may be employed to advantage in a baculovirus expression system. These include immediate-early (α), delayed-early (β), late (γ), or very late (δ), according to the phase of the viral infection during which they are expressed. The expression of these genes occurs sequentially, probably as the result of a "cascade" mechanism of transcriptional regulation. (Guarino and Summers, *J. Virol.* 57:563-571

(1986); Guarino and Summers, *J. Virol.* 61:2091-2099 (1987); Guarino and Summers, *Virol.* 162:444-451 (1988); all of which are herein incorporated by reference in their entirety).

Insect recombinant vectors are useful as intermediates for the infection or transformation of insect cell systems. For example, an insect recombinant vector containing a nucleic acid molecule encoding a baculovirus transcriptional promoter followed downstream by an insect signal DNA sequence is capable of directing the secretion of the desired biologically active protein from the insect cell. The vector may utilize a baculovirus transcriptional promoter region derived from any of the over 500 baculoviruses generally infecting insects, such as for example the Orders *Lepidoptera*, *Diptera*, *Orthoptera*, *Coleoptera* and *Hymenoptera*, including for example but not limited to the viral DNAs of *Autographa californica* MNPV, *Bombyx mori* NPV, *Trichoplusia ni* MNPV, *Rachiplusia ou* MNPV or *Galleria mellonella* MNPV, wherein said baculovirus transcriptional promoter is a baculovirus immediate-early gene IEl or IEN promoter; an immediate-early gene in combination with a baculovirus delayed-early gene promoter region selected from the group consisting of 39K and a *HindIII-k* fragment delayed-early gene; or a baculovirus late gene promoter. The immediate-early or delayed-early promoters can be enhanced with transcriptional enhancer elements. The insect signal DNA sequence may code for a signal peptide of a *Lepidopteran* adipokinetic hormone precursor or a signal peptide of the *Manduca sexta* adipokinetic hormone precursor (Summers, U.S. Patent No. 5,155,037; the entirety of which is herein incorporated by reference). Other insect signal DNA sequences include a signal peptide of the *Orthoptera Schistocerca gregaria* locust adipokinetic hormone precursor and the *Drosophila melanogaster* cuticle genes CP1, CP2, CP3 or CP4 or for an insect signal peptide having substantially a similar chemical composition and function (Summers, U.S. Patent No. 5,155,037).

Insect cells are distinctly different from animal cells. Insects have a unique life cycle and have distinct cellular properties such as the lack of intracellular plasminogen activators in which are present in vertebrate cells. Another difference is the high expression levels of protein products ranging from 1 to greater than 500 mg/liter and the ease at which cDNA can be cloned into cells (Frasier, *In Vitro Cell. Dev. Biol.* 25:225 (1989); Summers and Smith, In: *A Manual of Methods for Baculovirus Vectors and Insect Cell Culture Procedures*, Texas Ag. Exper. Station Bulletin No. 1555 (1988), both of which are incorporated by reference in their entirety).

Recombinant protein expression in insect cells is achieved by viral infection or stable transformation. For viral infection, the desired gene is cloned into baculovirus at the site of the wild-type polyhedron gene (Webb and Summers, *Technique* 2:173 (1990); Bishop and Posse, *Adv. Gene Technol.* 1:55 (1990); both of which are incorporated by reference in their entirety). The polyhedron gene is a component of a protein coat in occlusions which encapsulate virus particles. Deletion or insertion in the polyhedron gene results the failure to form occlusion bodies. Occlusion negative viruses are morphologically different from occlusion positive viruses and enable one skilled in the art to identify and purify recombinant viruses.

The vectors of present invention preferably contain one or more selectable markers which permit easy selection of transformed cells. A selectable marker is a gene the product of which provides, for example biocide or viral resistance, resistance to heavy metals, prototrophy to auxotrophs and the like. Selection may be accomplished by co-transformation, *e.g.*, as described in WO 91/17243, a nucleic acid sequence of the present invention may be operably linked to a suitable promoter sequence. The promoter sequence is a nucleic acid sequence which is recognized by the insect host cell for expression of the nucleic acid sequence. The promoter sequence contains transcription and translation control sequences which mediate the expression

of the protein or fragment thereof. The promoter may be any nucleic acid sequence which shows transcriptional activity in the insect host cell of choice and may be obtained from genes encoding polypeptides either homologous or heterologous to the host cell.

For example, a nucleic acid molecule encoding a protein or fragment thereof may also be operably linked to a suitable leader sequence. A leader sequence is a nontranslated region of a mRNA which is important for translation by the fungal host. The leader sequence is operably linked to the 5' terminus of the nucleic acid sequence encoding the protein or fragment thereof. The leader sequence may be native to the nucleic acid sequence encoding the protein or fragment thereof or may be obtained from foreign sources. Any leader sequence which is functional in the insect host cell of choice may be used in the present invention.

A polyadenylation sequence may also be operably linked to the 3' terminus of the nucleic acid sequence of the present invention. The polyadenylation sequence is a sequence which when transcribed is recognized by the insect host to add polyadenosine residues to transcribed mRNA. The polyadenylation sequence may be native to the nucleic acid sequence encoding the protein or fragment thereof or may be obtained from foreign sources. Any polyadenylation sequence which is functional in the fungal host of choice may be used in the present invention.

To avoid the necessity of disrupting the cell to obtain the protein or fragment thereof and to minimize the amount of possible degradation of the expressed polypeptide within the cell, it is preferred that expression of the polypeptide gene gives rise to a product secreted outside the cell. To this end, the protein or fragment thereof of the present invention may be linked to a signal peptide linked to the amino terminus of the protein or fragment thereof. A signal peptide is an amino acid sequence which permits the secretion of the protein or fragment thereof from the insect host into the culture medium. The signal peptide may be native to the protein or fragment

thereof of the invention or may be obtained from foreign sources. The 5' end of the coding sequence of the nucleic acid sequence of the present invention may inherently contain a signal peptide coding region naturally linked in translation reading frame with the segment of the coding region which encodes the secreted protein or fragment thereof.

At present, a mode of achieving secretion of a foreign gene product in insect cells is by way of the foreign gene's native signal peptide. Because the foreign genes are usually from non-insect organisms, their signal sequences may be poorly recognized by insect cells and hence, levels of expression may be suboptimal. However, the efficiency of expression of foreign gene products seems to depend primarily on the characteristics of the foreign protein. On average, nuclear localized or non-structural proteins are most highly expressed, secreted proteins are intermediate and integral membrane proteins are the least expressed. One factor generally affecting the efficiency of the production of foreign gene products in a heterologous host system is the presence of native signal sequences (also termed presequences, targeting signals, or leader sequences) associated with the foreign gene. The signal sequence is generally coded by a DNA sequence immediately following (5' to 3') the translation start site of the desired foreign gene.

The expression dependence on the type of signal sequence associated with a gene product can be represented by the following example: If a foreign gene is inserted at a site downstream from the translational start site of the baculovirus polyhedrin gene so as to produce a fusion protein (containing the N-terminus of the polyhedrin structural gene), the fused gene is highly expressed. But less expression is achieved when a foreign gene is inserted in a baculovirus expression vector immediately following the transcriptional start site and totally replacing the polyhedrin structural gene.

Insertions into the region -50 to -1 significantly alter (reduce) steady state transcription which, in turn, reduces translation of the foreign gene product. Use of the pVL941 vector optimizes transcription of foreign genes to the level of the polyhedrin gene transcription. Even though the transcription of a foreign gene may be optimal, optimal translation may vary because of several factors involving processing: signal peptide recognition, mRNA and ribosome binding, glycosylation, disulfide bond formation, sugar processing, oligomerization, for example.

The properties of the insect signal peptide are expected to be more optimal for the efficiency of the translation process in insect cells than those from vertebrate proteins. This phenomenon can generally be explained by the fact that proteins secreted from cells are synthesized as precursor molecules containing hydrophobic N-terminal signal peptides. The signal peptides direct transport of the select protein to its target membrane and are then cleaved by a peptidase on the membrane, such as the endoplasmic reticulum, when the protein passes through it.

Another exemplary insect signal sequence is the sequence encoding for *Drosophila* cuticle proteins such as CP1, CP2, CP3 or CP4 (Summers, U.S. Patent No. 5,278,050; the entirety of which is herein incorporated by reference). Most of a 9kb region of the *Drosophila* genome containing genes for the cuticle proteins has been sequenced. Four of the five cuticle genes contains a signal peptide coding sequence interrupted by a short intervening sequence (about 60 base pairs) at a conserved site. Conserved sequences occur in the 5' mRNA untranslated region, in the adjacent 35 base pairs of upstream flanking sequence and at -200 base pairs from the mRNA start position in each of the cuticle genes.

Standard methods of insect cell culture, cotransfection and preparation of plasmids are set forth in Summers and Smith (Summers and Smith, *A Manual of Methods for Baculovirus*

Vectors and Insect Cell Culture Procedures, Texas Agricultural Experiment Station Bulletin No. 1555, Texas A&M University (1987)). Procedures for the cultivation of viruses and cells are described in Volkman and Summers, *J. Virol* 19:820-832 (1975) and Volkman *et al.*, *J. Virol* 19:820-832 (1976); both of which are herein incorporated by reference in their entirety.

(e) Bacterial Constructs and Transformed Bacterial Cells

The present invention also relates to a bacterial recombinant vector comprising exogenous genetic material. The present invention also relates to a bacteria cell comprising a bacterial recombinant vector. The present invention also relates to methods for obtaining a recombinant bacteria host cell, comprising introducing into a bacterial host cell exogenous genetic material. . In a preferred embodiment the exogenous genetic material includes a nucleic acid molecule of the present invention having a sequence selected from the group consisting of SEQ ID NO: 1 through SEQ ID NO: 3853 or complements thereof or fragments of either or other nucleic acid molecule of the present invention.

The bacterial recombinant vector may be any vector which can be conveniently subjected to recombinant DNA procedures. The choice of a vector will typically depend on the compatibility of the vector with the bacterial host cell into which the vector is to be introduced. The vector may be a linear or a closed circular plasmid. The vector system may be a single vector or plasmid or two or more vectors or plasmids which together contain the total DNA to be introduced into the genome of the bacterial host. In addition, the bacterial vector may be an expression vector. Nucleic acid molecules encoding protein homologues or fragments thereof can, for example, be suitably inserted into a replicable vector for expression in the bacterium under the control of a suitable promoter for bacteria. Many vectors are available for this purpose and selection of the appropriate vector will depend mainly on the size of the nucleic acid to be

inserted into the vector and the particular host cell to be transformed with the vector. Each vector contains various components depending on its function (amplification of DNA or expression of DNA) and the particular host cell with which it is compatible. The vector components for bacterial transformation generally include, but are not limited to, one or more of the following: a signal sequence, an origin of replication, one or more marker genes and an inducible promoter.

In general, plasmid vectors containing replicon and control sequences that are derived from species compatible with the host cell are used in connection with bacterial hosts. The vector ordinarily carries a replication site, as well as marking sequences that are capable of providing phenotypic selection in transformed cells. For example, *E. coli* is typically transformed using pBR322, a plasmid derived from an *E. coli* species (see, e.g., Bolivar *et al.*, *Gene* 2:95 (1977); the entirety of which is herein incorporated by reference). pBR322 contains genes for ampicillin and tetracycline resistance and thus provides easy means for identifying transformed cells. The pBR322 plasmid, or other microbial plasmid or phage, also generally contains, or is modified to contain, promoters that can be used by the microbial organism for expression of the selectable marker genes.

Nucleic acid molecules encoding protein or fragments thereof may be expressed not only directly, but also as a fusion with another polypeptide, preferably a signal sequence or other polypeptide having a specific cleavage site at the N-terminus of the mature polypeptide. In general, the signal sequence may be a component of the vector, or it may be a part of the polypeptide DNA that is inserted into the vector. The heterologous signal sequence selected should be one that is recognized and processed (i.e., cleaved by a signal peptidase) by the host cell. For bacterial host cells that do not recognize and process the native polypeptide signal

sequence, the signal sequence is substituted by a bacterial signal sequence selected, for example, from the group consisting of the alkaline phosphatase, penicillinase, lpp, or heat-stable enterotoxin II leaders.

Both expression and cloning vectors contain a nucleic acid sequence that enables the vector to replicate in one or more selected host cells. Generally, in cloning vectors this sequence is one that enables the vector to replicate independently of the host chromosomal DNA and includes origins of replication or autonomously replicating sequences. Such sequences are well known for a variety of bacteria. The origin of replication from the plasmid pBR322 is suitable for most Gram-negative bacteria.

Expression and cloning vectors also generally contain a selection gene, also termed a selectable marker. This gene encodes a protein necessary for the survival or growth of transformed host cells grown in a selective culture medium. Host cells not transformed with the vector containing the selection gene will not survive in the culture medium. Typical selection genes encode proteins that (a) confer resistance to antibiotics or other toxins, e.g., ampicillin, neomycin, methotrexate, or tetracycline, (b) complement auxotrophic deficiencies, or (c) supply critical nutrients not available from complex media, e.g., the gene encoding D-alanine racemase for *Bacilli*. One example of a selection scheme utilizes a drug to arrest growth of a host cell. Those cells that are successfully transformed with a heterologous protein homologue or fragment thereof produce a protein conferring drug resistance and thus survive the selection regimen.

The expression vector for producing a protein or fragment thereof can also contain an inducible promoter that is recognized by the host bacterial organism and is operably linked to the nucleic acid encoding, for example, the nucleic acid molecule encoding the protein homologue or fragment thereof of interest. Inducible promoters suitable for use with bacterial hosts include the

β-lactamase and lactose promoter systems (Chang *et al.*, *Nature* 275:615 (1978); Goeddel *et al.*, *Nature* 281:544 (1979); both of which are herein incorporated by reference in their entirety), the arabinose promoter system (Guzman *et al.*, *J. Bacteriol.* 174:7716-7728 (1992); the entirety of which is herein incorporated by reference), alkaline phosphatase, a tryptophan (trp) promoter system (Goeddel, *Nucleic Acids Res.* 8:4057 (1980); EP 36,776; both of which are herein incorporated by reference in their entirety) and hybrid promoters such as the tac promoter (deBoer *et al.*, *Proc. Natl. Acad. Sci. (USA)* 80:21-25 (1983); the entirety of which is herein incorporated by reference). However, other known bacterial inducible promoters are suitable (Siebenlist *et al.*, *Cell* 20:269 (1980); the entirety of which is herein incorporated by reference).

Promoters for use in bacterial systems also generally contain a Shine-Dalgarno (S.D.) sequence operably linked to the DNA encoding the polypeptide of interest. The promoter can be removed from the bacterial source DNA by restriction enzyme digestion and inserted into the vector containing the desired DNA.

Construction of suitable vectors containing one or more of the above-listed components employs standard ligation techniques. Isolated plasmids or DNA fragments are cleaved, tailored and re-ligated in the form desired to generate the plasmids required. Examples of available bacterial expression vectors include, but are not limited to, the multifunctional *E. coli* cloning and expression vectors such as Bluescript™ (Stratagene, La Jolla, CA), in which, for example, encoding an *A. nidulans* protein homologue or fragment thereof homologue, may be ligated into the vector in frame with sequences for the amino-terminal Met and the subsequent 7 residues of β-galactosidase so that a hybrid protein is produced; pIN vectors (Van Heeke and Schuster, *J. Biol. Chem.* 264:5503-5509 (1989), the entirety of which is herein incorporated by reference);

and the like. pGEX vectors (Promega, Madison Wisconsin U.S.A.) may also be used to express foreign polypeptides as fusion proteins with glutathione S-transferase (GST). In general, such fusion proteins are soluble and can easily be purified from lysed cells by adsorption to glutathione-agarose beads followed by elution in the presence of free glutathione. Proteins made in such systems are designed to include heparin, thrombin or factor XA protease cleavage sites so that the cloned polypeptide of interest can be released from the GST moiety at will.

Suitable host bacteria for a bacterial vector include archaeobacteria and eubacteria, especially eubacteria and most preferably *Enterobacteriaceae*. Examples of useful bacteria include *Escherichia*, *Enterobacter*, *Azotobacter*, *Erwinia*, *Bacillus*, *Pseudomonas*, *Klebsiella*, *Proteus*, *Salmonella*, *Serratia*, *Shigella*, *Rhizobia*, *Vitreoscilla* and *Paracoccus*. Suitable *E. coli* hosts include *E. coli* W3110 (American Type Culture Collection (ATCC) 27,325, Manassas, Virginia U.S.A.), *E. coli* 294 (ATCC 31,446), *E. coli* B and *E. coli* X1776 (ATCC 31,537). These examples are illustrative rather than limiting. Mutant cells of any of the above-mentioned bacteria may also be employed. It is, of course, necessary to select the appropriate bacteria taking into consideration replicability of the replicon in the cells of a bacterium. For example, *E. coli*, *Serratia*, or *Salmonella* species can be suitably used as the host when well known plasmids such as pBR322, pBR325, pACYC177, or pKN410 are used to supply the replicon. *E. coli* strain W3110 is a preferred host or parent host because it is a common host strain for recombinant DNA product fermentations. Preferably, the host cell should secrete minimal amounts of proteolytic enzymes.

Host cells are transfected and preferably transformed with the above-described vectors and cultured in conventional nutrient media modified as appropriate for inducing promoters, selecting transformants, or amplifying the genes encoding the desired sequences.

Numerous methods of transfection are known to the ordinarily skilled artisan, for example, calcium phosphate and electroporation. Depending on the host cell used, transformation is done using standard techniques appropriate to such cells. The calcium treatment employing calcium chloride, as described in section 1.82 of Sambrook *et al.*, *Molecular Cloning: A Laboratory Manual*, New York: Cold Spring Harbor Laboratory Press, (1989), is generally used for bacterial cells that contain substantial cell-wall barriers. Another method for transformation employs polyethylene glycol/DMSO, as described in Chung and Miller (Chung and Miller, *Nucleic Acids Res.* 16:3580 (1988); the entirety of which is herein incorporated by reference). Yet another method is the use of the technique termed electroporation.

Bacterial cells used to produce the polypeptide of interest for purposes of this invention are cultured in suitable media in which the promoters for the nucleic acid encoding the heterologous polypeptide can be artificially induced as described generally, e.g., in Sambrook *et al.*, *Molecular Cloning: A Laboratory Manual*, New York: Cold Spring Harbor Laboratory Press, (1989). Examples of suitable media are given in U.S. Pat. Nos. 5,304,472 and 5,342,763; both of which are incorporated by reference in their entirety.

In addition to the above discussed procedures, practitioners are familiar with the standard resource materials which describe specific conditions and procedures for the construction, manipulation and isolation of macromolecules (e.g., DNA molecules, plasmids, etc.), generation of recombinant organisms and the screening and isolating of clones, (see for example, Sambrook *et al.*, *Molecular Cloning: A Laboratory Manual*, Cold Spring Harbor Press (1989); Mailga *et al.*, *Methods in Plant Molecular Biology*, Cold Spring Harbor Press (1995), the entirety of which

is herein incorporated by reference; Birren *et al.*, *Genome Analysis: Analyzing DNA*, 1, Cold Spring Harbor, New York, the entirety of which is herein incorporated by reference).

(f) Computer Readable Media

The nucleotide sequence provided in SEQ ID NO: 1 through SEQ ID NO: 3853 or fragment thereof, or complement thereof, or a nucleotide sequence at least 90% identical, preferably 95%, identical even more preferably 99% or 100% identical to the sequence provided in SEQ ID NO: 1 through SEQ ID NO: 3853 or fragment thereof, or complement thereof, can be “provided” in a variety of mediums to facilitate use. Such a medium can also provide a subset thereof in a form that allows a skilled artisan to examine the sequences.

A preferred subset of nucleotide sequences are those nucleic acid sequences that encode a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or complement thereof or fragment of either, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or complement thereof or fragment of either, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or complement thereof or fragment of either, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or complement thereof or fragment of either and a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* other transcription factor or complement thereof or fragment of either.

A further preferred subset of nucleic acid sequences is where the subset of sequences is two proteins or fragments thereof, more preferably three proteins or fragments thereof and even more preferable four transcription factors or fragments thereof, these nucleic acid sequences are selected from the group that comprises a maize, soybean or *Arabidopsis thaliana* homeobox transcription factor or complement thereof or fragment of either, a nucleic acid molecule that

encodes a maize, soybean or *Arabidopsis thaliana* HLH transcription factor or complement thereof or fragment of either, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* leucine zipper transcription factor or complement thereof or fragment of either, a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* zinc finger transcription factor or complement thereof or fragment of either and a nucleic acid molecule that encodes a maize, soybean or *Arabidopsis thaliana* other transcription factor or complement thereof or fragment of either.

In one application of this embodiment, a nucleotide sequence of the present invention can be recorded on computer readable media. As used herein, "computer readable media" refers to any medium that can be read and accessed directly by a computer. Such media include, but are not limited to: magnetic storage media, such as floppy discs, hard disc, storage medium and magnetic tape; optical storage media such as CD-ROM; electrical storage media such as RAM and ROM; and hybrids of these categories such as magnetic/optical storage media. A skilled artisan can readily appreciate how any of the presently known computer readable mediums can be used to create a manufacture comprising computer readable medium having recorded thereon a nucleotide sequence of the present invention.

As used herein, "recorded" refers to a process for storing information on computer readable medium. A skilled artisan can readily adopt any of the presently known methods for recording information on computer readable medium to generate media comprising the nucleotide sequence information of the present invention. A variety of data storage structures are available to a skilled artisan for creating a computer readable medium having recorded thereon a nucleotide sequence of the present invention. The choice of the data storage structure will generally be based on the means chosen to access the stored information. In addition, a variety

of data processor programs and formats can be used to store the nucleotide sequence information of the present invention on computer readable medium. The sequence information can be represented in a word processing text file, formatted in commercially-available software such as WordPerfect and Microsoft Word, or represented in the form of an ASCII file, stored in a database application, such as DB2, Sybase, Oracle, or the like. A skilled artisan can readily adapt any number of data processor structuring formats (e.g. text file or database) in order to obtain computer readable medium having recorded thereon the nucleotide sequence information of the present invention.

By providing one or more of nucleotide sequences of the present invention, a skilled artisan can routinely access the sequence information for a variety of purposes. Computer software is publicly available which allows a skilled artisan to access sequence information provided in a computer readable medium. The examples which follow demonstrate how software which implements the BLAST (Altschul *et al.*, *J. Mol. Biol.* 215:403-410 (1990), the entirety of which is herein incorporated by reference) and BLAZE (Brutlag *et al.*, *Comp. Chem.* 17:203-207 (1993), the entirety of which is herein incorporated by reference) search algorithms on a Sybase system can be used to identify open reading frames (ORFs) within the genome that contain homology to ORFs or proteins from other organisms. Such ORFs are protein-encoding fragments within the sequences of the present invention and are useful in producing commercially important proteins such as enzymes used in amino acid biosynthesis, metabolism, transcription, translation, RNA processing, nucleic acid and a protein degradation, protein modification and DNA replication, restriction, modification, recombination and repair.

The present invention further provides systems, particularly computer-based systems, which contain the sequence information described herein. Such systems are designed to identify

commercially important fragments of the nucleic acid molecule of the present invention. As used herein, "a computer-based system" refers to the hardware means, software means and data storage means used to analyze the nucleotide sequence information of the present invention. The minimum hardware means of the computer-based systems of the present invention comprises a central processing unit (CPU), input means, output means and data storage means. A skilled artisan can readily appreciate that any one of the currently available computer-based system are suitable for use in the present invention.

As indicated above, the computer-based systems of the present invention comprise a data storage means having stored therein a nucleotide sequence of the present invention and the necessary hardware means and software means for supporting and implementing a search means. As used herein, "data storage means" refers to memory that can store nucleotide sequence information of the present invention, or a memory access means which can access manufactures having recorded thereon the nucleotide sequence information of the present invention. As used herein, "search means" refers to one or more programs which are implemented on the computer-based system to compare a target sequence or target structural motif with the sequence information stored within the data storage means. Search means are used to identify fragments or regions of the sequence of the present invention that match a particular target sequence or target motif. A variety of known algorithms are disclosed publicly and a variety of commercially available software for conducting search means are available can be used in the computer-based systems of the present invention. Examples of such software include, but are not limited to, MacPattern (EMBL), BLASTIN and BLASTIX (NCBIA). One of the available algorithms or implementing software packages for conducting homology searches can be adapted for use in the present computer-based systems.

The most preferred sequence length of a target sequence is from about 10 to 100 amino acids or from about 30 to 300 nucleotide residues. However, it is well recognized that during searches for commercially important fragments of the nucleic acid molecules of the present invention, such as sequence fragments involved in gene expression and protein processing, may be of shorter length.

As used herein, "a target structural motif," or "target motif," refers to any rationally selected sequence or combination of sequences in which the sequence(s) are chosen based on a three-dimensional configuration which is formed upon the folding of the target motif. There are a variety of target motifs known in the art. Protein target motifs include, but are not limited to, enzymatic active sites and signal sequences. Nucleic acid target motifs include, but are not limited to, promoter sequences, *cis* elements, hairpin structures and inducible expression elements (protein binding sequences).

Thus, the present invention further provides an input means for receiving a target sequence, a data storage means for storing the target sequences of the present invention sequence identified using a search means as described above and an output means for outputting the identified homologous sequences. A variety of structural formats for the input and output means can be used to input and output information in the computer-based systems of the present invention. A preferred format for an output means ranks fragments of the sequence of the present invention by varying degrees of homology to the target sequence or target motif. Such presentation provides a skilled artisan with a ranking of sequences which contain various amounts of the target sequence or target motif and identifies the degree of homology contained in the identified fragment.

A variety of comparing means can be used to compare a target sequence or target motif with the data storage means to identify sequence fragments sequence of the present invention. For example, implementing software which implement the BLAST and BLAZE algorithms (Altschul *et al.*, *J. Mol. Biol.* 215:403-410 (1990)) can be used to identify open frames within the nucleic acid molecules of the present invention. A skilled artisan can readily recognize that any one of the publicly available homology search programs can be used as the search means for the computer-based systems of the present invention.

Having now generally described the invention, the same will be more readily understood through reference to the following examples which are provided by way of illustration and are not intended to be limiting of the present invention, unless specified.

Example 1

The MONN01 cDNA library is a normalized library generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) total leaf tissue at the V6 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the 6-leaf development

stage. The older, more juvenile leaves, which are in a basal position, as well as the younger, more adult leaves, which are more apical are cut at the base of the leaves. The leaves are then pooled and immediately transferred to liquid nitrogen containers in which the pooled leaves are crushed. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON001 cDNA library is generated from maize (B73, Illinois Foundation Seeds, Champaign, Illinois U.S.A.) immature tassels at the V6 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in a greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue from the maize plant is collected at the V6 stage. At that stage the tassel is an immature tassel of about 2-3 cm in length. The tassels are removed and frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON003 library is generated from maize (B73 x Mo17, Illinois Foundation Seeds, Champaign, Illinois U.S.A.) roots at the V6 developmental stage. Seeds are planted at a depth of approximately 3 cm in coil into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth, the seedlings are transplanted into 10 inch pots containing the Metro 200 growing medium. Plants are watered daily before transplantation and approximately

3 times a week after transplantation. Peters 15-16-17 fertilizer is applied approximately three times per week after transplanting at a concentration of 150 ppm N. Two to three times during the life time of the plant from transplanting to flowering a total of approximately 900 mg Fe is added to each pot. Maize plants are grown in the green house in approximately 15hr day/9hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the 6 leaf development stage. The root system is cut from maize plant and washed with water to free it from the soil. The tissue is then immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON004 cDNA library is generated from maize (B73 x Mo17, Illinois Foundation Seeds, Champaign, Illinois U.S.A.) total leaf tissue at the V6 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the 6-leaf development stage. The older, more juvenile leaves, which are in a basal position, as well as the younger, more adult leaves, which are more apical are cut at the base of the leaves.

The leaves are then pooled and immediately transferred to liquid nitrogen containers in which the pooled leaves are crushed. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON005 cDNA library is generated from maize (B73 x Mo17, Illinois Foundation Seeds, Champaign Illinois, U.S.A.) root tissue at the V6 development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the 6-leaf development stage. The root system is cut from the mature maize plant and washed with water to free it from the soil. The tissue is immediately frozen in liquid nitrogen and the harvested tissue is then stored at -80°C until RNA preparation.

The SATMON006 cDNA library is generated from maize (B73 x Mo17, Illinois Foundation Seeds, Champaign Illinois, U.S.A.) total leaf tissue at the V6 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after

transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the 6-leaf development stage. The older more juvenile leaves, which are in a basal position, as well as the younger more adult leaves, which are more apical are cut at the base of the leaves. The leaves are then pooled and immediately transferred to liquid nitrogen containers in which the pooled leaves are crushed. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON007 cDNA library is generated from the primary root tissue of 5 day old maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) seedlings. Seeds are planted on a moist filter paper on a covered tray that is kept in the dark until germination (one day). After germination, the trays, along with the moist paper, are moved to a greenhouse where the maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles for approximately 5 days. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. The primary root tissue is collected when the seedlings are 5 days old. At this stage, the primary root (radicle) is pushed through the coleorhiza which itself is pushed through the seed coat. The primary root, which is about 2-3 cm long, is cut and immediately frozen in liquid nitrogen and then stored at -80°C until RNA preparation.

The SATMON008 cDNA library is generated from the primary shoot (coleoptile 2-3 cm) of maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) seedlings which are approximately

5 days old. Seeds are planted on a moist filter paper on a covered tray that is kept in the dark until germination (one day). Then the trays containing the seeds are moved to a greenhouse at 15hr daytime/9 hr nighttime cycles and grown until they are 5 days post germination. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Tissue is collected when the seedlings are 5 days old. At this stage, the primary shoot (coleoptile) is pushed through the seed coat and is about 2-3 cm long. The coleoptile is dissected away from the rest of the seedling, immediately frozen in liquid nitrogen and then stored at -80°C until RNA preparation.

The SATMON009 cDNA library is generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) leaves at the 8 leaf stage (V8 plant development stage). Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15 hr day/9 hr night cycles. The daytime temperature is 80°F and the nighttime temperature is 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the 8-leaf development stage. The older more juvenile leaves, which are in a basal position, as well as the younger more adult leaves, which are more apical, are cut at the base of the leaves. The leaves are then pooled and then immediately transferred to liquid

nitrogen containers in which the pooled leaves are crushed. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON010 cDNA library is generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) root tissue at the V8 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15 hr day/9 hr night cycles. The daytime temperature is 80°F and the nighttime temperature is 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the V8 development stage. The root system is cut from this mature maize plant and washed with water to free it from the soil. The tissue is immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON011 cDNA library is generated from undeveloped maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) leaf at the V6 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to

flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the 6-leaf development stage. The second youngest leaf which is at the base of the apical leaf of V6 stage maize plant is cut at the base and immediately transferred to liquid nitrogen containers in which the leaf is crushed. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON012 cDNA library is generated from 2 day post germination maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) seedlings. Seeds are planted on a moist filter paper on a covered tray that is kept in the dark until germination (one day). Then the trays containing the seeds are moved to the greenhouse and grown at 15hr daytime/9 hr nighttime cycles until 2 days post germination. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Tissue is collected when the seedlings are 2 days old. At the two day stage, the coleorhiza is pushed through the seed coat and the primary root (the radicle) is pierced the coleorhiza but is barely visible. Also, at this two day stage, the coleoptile is just emerging from the seed coat. The 2 days post germination seedlings are then immersed in liquid nitrogen and crushed. The harvested tissue is stored at -80°C until preparation of total RNA.

The SATMON013 cDNA library is generated from apical maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) meristem founder at the V4 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the

same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Prior to tissue collection, the plant is at the 4 leaf stage. The lead at the apex of the V4 stage maize plant is referred to as the meristem founder. This apical meristem founder is cut, immediately frozen in liquid nitrogen and crushed. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON014 cDNA library is generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) endosperm fourteen days after pollination. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. After the V10 stage, the maize plant ear shoots are ready for fertilization. At this stage, the ear shoots are enclosed in a paper bag before silk emergence to withhold the pollen. The ear shoots are

pollinated and 14 days after pollination, the ears are pulled out and then the kernels are plucked out of the ears. Each kernel is then dissected into the embryo and the endosperm and the aleurone layer is removed. After dissection, the endosperms are immediately frozen in liquid nitrogen and then stored at -80°C until RNA preparation.

The SATMON016 library is a maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) sheath library collected at the V8 developmental stage. Seeds are planted in a depth of approximately 3 cm in solid into 2-3 inch pots containing Metro growing medium. After 2-3 weeks growth, they are transplanted into 10" pots containing the same. Plants are watered daily before transplantation and approximately the times a week after transplantation. Peters 15-16-17 fertilizer is applied approximately three times per week after transplanting, at a strength of 150 ppm N. Two to three times during the life time of the plant from transplanting to flowering, a total of approximately 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15hr day/9hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. When the maize plants are at the V8 stage the 5th and 6th leaves from the bottom exhibit fully developed leaf blades. At the base of these leaves, the ligule is differentiated and the leaf blade is joined to the sheath. The sheath is dissected away from the base of the leaf then the sheath is frozen in liquid nitrogen and crushed. The tissue is then stored at -80°C until RNA preparation.

The SATMON017 cDNA library is generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) embryo seventeen days after pollination. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3

weeks growth the seeds are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. After the V10 stage, the ear shoots of maize plant, which are ready for fertilization, are enclosed in a paper bag before silk emergence to withhold the pollen. The ear shoots are fertilized and 21 days after pollination, the ears are pulled out and the kernels are plucked out of the ears. Each kernel is then dissected into the embryo and the endosperm and the aleurone layer is removed. After dissection, the embryos are immediately frozen in liquid nitrogen and then stored at -80°C until RNA preparation.

The SATMON019 (Lib3054) cDNA library is generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) culm (stem) at the V8 developmental stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime

temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. When the maize plant is at the V8 stage, the 5th and 6th leaves from the bottom have fully developed leaf blades. The region between the nodes of the 5th and the sixth leaves from the bottom is the region of the stem that is collected. The leaves are pulled out and the sheath is also torn away from the stem. This stem tissue is completely free of any leaf and sheath tissue. The stem tissue is then frozen in liquid nitrogen and stored at -80°C until RNA preparation.

The SATMON020 cDNA library is from a maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) Hill Type II-Initiated Callus. Petri plates containing approximately 25 ml of Type II initiation media are prepared. This medium contains N6 salts and vitamins, 3% sucrose, 2.3 g/liter proline 0.1 g/liter enzymatic casein hydrolysate, 2mg/liter 2,4 – dichloro phenoxy-acetic acid (2,4, D), 15.3 mg/liter AgNO₃ and 0.8% bacto agar and is adjusted to pH 6.0 before autoclaving. At 9-11 days after pollination, an ear with immature embryos measuring approximately 1-2 mm in length is chosen. The husks and silks are removed and then the ear is broken into halves and placed in an autoclaved solution of Clorox/TWEEN 20 sterilizing solution. Then the ear is rinsed with deionized water. Then each embryo is extracted from the kernel. Intact embryos are placed in contact with the medium, scutellar side up). Multiple embryos are plated on each plate and the plates are incubated in the dark at 25°C. Type II calluses are friable, can be subcultured with a spatula, frequently regenerate via somatic embryogenesis and are relatively undifferentiated. As seen in the microscope, the Tape II calluses show color ranging from translucent to light yellow and heterogeneity on with respect to embryoid structure as well as stage of embryoid development. Once Type II callus are formed, the calluses is transferred to type II callus maintenance medium without AgNO₃. Every 7-10

days, the callus is subcultured. About 4 weeks after embryo isolation the callus is removed from the plates and then frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA preparation.

The SATMON021 cDNA library is generated from the immature maize (DK604, Dekalb Genetics, Dekalb Illinois, U.S.A.) tassel at the V8 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F . Supplemental lighting is provided by 1000 W sodium vapor lamps. As the maize plant enters the V8 stage, tassels which are 15-20 cm in length are collected and frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA preparation.

The SATMON022 cDNA library is generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) ear (growing silks) at the V8 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to

flowering, a total of 900 mg Fe is added to each pot. *Zea mays* plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the plant is in the V8 stage. At this stage, some immature ear shoots are visible. The immature ear shoots (approximately 1 cm in length) are pulled out, frozen in liquid nitrogen and then stored at -80°C until RNA preparation.

The SATMON23 cDNA library is generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) ear (growing silk) at the V8 development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. When the tissue is harvested at the V8 stage, the length of the ear that is harvested is about 10-15 cm and the silks are just exposed (approximately 1 inch). The ear along with the silks is frozen in liquid nitrogen and then the tissue is stored at -80°C until RNA preparation.

The SATMON024 cDNA library is generated from the immature maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) tassel at the V9 development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium.

After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. As a maize plant enters the V9 stage, the tassel is rapidly developing and a 37 cm tassel along with the glume, anthers and pollen is collected and frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA preparation.

The SATMON025 cDNA library is from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) Hill Type II-Regenerated Callus. Type II callus is grown in initiation media as described for SATMON020 and then the embryoids on the surface of the Type II callus are allowed to mature and germinate. The 1-2 gm fresh weight of the soft friable type callus containing numerous embryoids are transferred to 100 x 15 mm petri plates containing 25 ml of regeneration media. Regeneration media consists of Murashige and Skoog (MS) basal salts, modified White's vitamins (0.2 g/liter glycine and 0.5 g/liter myo-inositol and 0.8% bacto agar (6SMS0D)). The plates are then placed in the dark after covering with parafilm. After 1 week, the plates are moved to a lighted growth chamber with 16 hr light and 8 hr dark photoperiod. Three weeks after plating the Type II callus to 6SMS0D, the callus exhibit shoot formation. The callus and the shoots are transferred to fresh 6SMS0D plates for another 2 weeks. The callus and the shoots are then transferred to petri plates with reduced sucrose (3SMS0D). Upon distinct formation of a root and shoot, the newly developed green plants are then removed out with a

spatula and frozen in liquid nitrogen containers. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON026 cDNA library is generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) juvenile/adult shift leaves at the V8 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F . Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plants are at the 8-leaf development stage. Leaves are founded sequentially around the meristem over weeks of time and the older, more juvenile leaves arise earlier and in a more basal position than the younger, more adult leaves, which are in a more apical position. In a V8 plant, some leaves which are in the middle portion of the plant exhibit characteristics of both juvenile as well as adult leaves. They exhibit a yellowing color but also exhibit, in part, a green color. These leaves are termed juvenile/adult shift leaves. The juvenile/adult shift leaves (the 4th, 5th leaves from the bottom) are cut at the base, pooled and transferred to liquid nitrogen in which they are then crushed. The harvested tissue is then stored at -80°C until RNA preparation.



The SATMON027 cDNA library is generated from 6 day maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) leaves. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the Metro 200 growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. *Zea mays* plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Prior to tissue collection, when the plant is at the 8-leaf stage, water is held back for six days. The older, more juvenile leaves, which are in a basal position, as well as the younger, more adult leaves, which are more apical, are all cut at the base of the leaves. All the leaves exhibit significant wilting. The leaves are then pooled and immediately transferred to liquid nitrogen containers in which the pooled leaves are then crushed. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON028 cDNA library is generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) roots at the V8 developmental stage that are subject to six days water stress. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the Metro 200 growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per

week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Prior to tissue collection, when the plant is at the 8-leaf stage, water is held back for six days. The root system is cut, shaken and washed to remove soil. Root tissue is then pooled and immediately transferred to liquid nitrogen containers in which the pooled leaves are then crushed. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON029 cDNA library is generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) seedlings at the etiolated stage. Seeds are planted on a moist filter paper on a covered tray that is kept in the dark for 4 days at approximately 70°F. Tissue is collected when the seedlings are 4 days old. By 4 days, the primary root has penetrated the coleorhiza and is about 4-5 cm and the secondary lateral roots have also made their appearance. The coleoptile has also pushed through the seed coat and is about 4-5 cm long. The seedlings are frozen in liquid nitrogen and crushed. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON030 cDNA library is generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) root tissue at the V4 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth, they are transplanted into 10 inch pots containing the same. Plants are watered daily before transplantation and approximately 3 times a week after transplantation. Peters 15-16-17 fertilizer is applied approximately three times per week after transplanting, at a

strength of 150 ppm N. Two to three times during the life time of the plant, from transplanting to flowering, a total of approximately 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15hr day/9hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 sodium vapor lamps. Tissue is collected when the maize plant is at the 4 leaf development stage. The root system is cut from the mature maize plant and washed with water to free it from the soil. The tissue is then immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON031 cDNA library is generated from the maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) leaf tissue at the V4 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15 hr day/9 hr night cycles. The daytime temperature is 80°F and the nighttime temperature is 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the 4-leaf development stage. The third leaf from the bottom is cut at the base and immediately frozen in liquid nitrogen and crushed. The tissue is immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON033 cDNA library is generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) embryo tissue 13 days after pollination. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. After the V10 stage, the ear shoots of the maize plant, which are ready for fertilization, are enclosed in a paper bag before silk emergent to withhold the pollen. The ear shoots are pollinated and 13 days after pollination, the ears are pulled out and then the kernels are plucked cut of the ears. Each kernel is then dissected into the embryo and the endosperm and the aleurone layer is removed. After dissection, the embryos are immediately frozen in liquid nitrogen and then stored at -80°C until RNA preparation.

The SATMON034 cDNA library is generated from cold stressed maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) seedlings. Seeds are planted on a moist filter paper on a covered tray that is kept on at 10°C for 7 days. After 7 days, the temperature is shifted to 15°C for one day until germination of the seed. Tissue is collected once the seedlings are 1 day old. At this point, the coleorhiza has just pushed out of the seed coat and the primary root is just making its appearance. The coleoptile has not yet pushed completely through the seed coat and

is also just making its appearance. These 1 day old cold stressed seedlings are frozen in liquid nitrogen and crushed. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMON~001 (Lib36, Lib83, Lib84) cDNA library is generated from maize leaves at the V8 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in a greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue from the maize plant is collected at the V8 stage. The older more juvenile leaves in a basal position as well as the younger more adult leaves which are more apical are all cut at the base, pooled and frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SATMONN01 cDNA library is generated from maize (B73, Illinois Foundation Seeds, Champaign, Illinois U.S.A.) normalized immature tassels at the V6 plant development stage normalized tissue. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during

the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in a greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue from the maize plant is collected at the V6 stage. At that stage the tassel is an immature tassel of about 2-3 cm in length. The tassels are removed and frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation. Single stranded and double stranded DNA representing approximately 1×10^6 colony forming units are isolated using standard protocols. RNA, complementary to the single stranded DNA, is synthesized using the double stranded DNA as a template. Biotinylated dATP is incorporated into the RNA during the synthesis reaction. The single stranded DNA is mixed with the biotinylated RNA in a 1:10 molar ratio) and allowed to hybridize. DNA-RNA hybrids are captured on Dynabeads M280 streptavidin (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The dynabeads with captured hybrids are collected with a magnet. The non-hybridized single stranded molecules remaining after hybrid capture are converted to double stranded form and represent the primary normalized library.

The SATMONN04 cDNA library is generated from maize (B73 x Mo17, Illinois Foundation Seeds, Champaign, Illinois U.S.A.) normalized total leaf tissue at the V6 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of

the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the 6-leaf development stage. The older, more juvenile leaves, which are in a basal position, as well as the younger, more adult leaves, which are more apical are cut at the base of the leaves. The leaves are then pooled and immediately transferred to liquid nitrogen containers in which the pooled leaves are crushed. The harvested tissue is then stored at -80°C until RNA preparation. Single stranded and double stranded DNA representing approximately 1×10^6 colony forming units are isolated using standard protocols. RNA, complementary to the single stranded DNA, is synthesized using the double stranded DNA as a template. Biotinylated dATP is incorporated into the RNA during the synthesis reaction. The single stranded DNA is mixed with the biotinylated RNA in a 1:10 molar ratio) and allowed to hybridize. DNA-RNA hybrids are captured on Dynabeads M280 streptavidin (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The dynabeads with captured hybrids are collected with a magnet. The non-hybridized single stranded molecules remaining after hybrid capture are converted to double stranded form and represent the primary normalized library.

The SATMONN05 cDNA library is generated from maize (B73 x Mo17, Illinois Foundation Seeds, Champaign Illinois, U.S.A.) normalized root tissue at the V6 development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three

times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the 6-leaf development stage. The root system is cut from the mature maize plant and washed with water to free it from the soil. The tissue is immediately frozen in liquid nitrogen and the harvested tissue is then stored at -80°C until RNA preparation. The single stranded and double stranded DNA representing approximately 1×10^6 colony forming units are isolated using standard protocols. RNA, complementary to the single stranded DNA, is synthesized using the double stranded DNA as a template. Biotinylated dATP is incorporated into the RNA during the synthesis reaction. The single stranded DNA is mixed with the biotinylated RNA in a 1:10 molar ratio) and allowed to hybridize. DNA-RNA hybrids are captured on Dynabeads M280 streptavidin (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The dynabeads with captured hybrids are collected with a magnet. The non-hybridized single stranded molecules remaining after hybrid capture are converted to double stranded form and represent the primary normalized library.

The SATMONN06 cDNA library is generated from maize (B73 x Mo17, Illinois Foundation Seeds, Champaign Illinois, U.S.A.) normalized total leaf tissue at the V6 plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10

inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the 6-leaf development stage. The older more juvenile leaves, which are in a basal position, as well as the younger more adult leaves, which are more apical are cut at the base of the leaves. The leaves are then pooled and immediately transferred to liquid nitrogen containers in which the pooled leaves are crushed. The harvested tissue is then stored at -80°C until RNA preparation. Single stranded and double stranded DNA representing approximately 1×10^6 colony forming units are isolated using standard protocols. RNA, complementary to the single stranded DNA, is synthesized using the double stranded DNA as a template. Biotinylated dATP is incorporated into the RNA during the synthesis reaction. The single stranded DNA is mixed with the biotinylated RNA in a 1:10 molar ratio) and allowed to hybridize. DNA-RNA hybrids are captured on Dynabeads M280 streptavidin (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The dynabeads with captured hybrids are collected with a magnet. The non-hybridized single stranded molecules remaining after hybrid capture are converted to double stranded form and represent the primary normalized library.

The CMZ029 (SATMON036) cDNA library is generated from maize (DK604, Dekalb Genetics, Dekalb, Illinois U.S.A.) endosperm 22 days after pollination. Seeds are planted at a

depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the green house in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. After the V10 stage, the ear shoots of the maize plant, which are ready for fertilization, are enclosed in a paper bag before silk emergent to withhold the pollen. The ear shoots are pollinated and 22 days after pollination, the ears are pulled out and then the kernels are plucked out of the ears. Each kernel is then dissected into the embryo and the endosperm and the alurone layer is removed. After dissection, the endosperms are immediately frozen in liquid nitrogen and then stored at -80°C until RNA preparation.

The CMz030 (Lib143) cDNA library is generated from maize seedling tissue two days post germination. Seeds are planted on a moist filter paper on a covered tray that is kept in the dark until germination. The trays are then moved to the bench top at 15 hr daytime/9 hr nighttime cycles for 2 days post-germination. The day time temperature is 80°F and the nighttime temperature is 70°F. Tissue is collected when the seedlings are 2 days old. At this stage, the coleorrhiza has pushed through the seed coat and the primary root (the radicle) is just piercing the coleorrhiza and is barely visible. The seedlings are placed at 42°C for 1 hour.

Following the heat shock treatment, the seedlings are immersed in liquid nitrogen and crushed.

The harvested tissue is stored at -80° until RNA preparation.

The CMz031 (Lib148) cDNA library is generated from maize pollen tissue at the V10+ plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F . Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected from V10+ stage plants. The ear shoots, which are ready for fertilization, are enclosed in a paper bag to withhold pollen. Twenty-one days after pollination, prior to removing the ears, the paper bag is shaken to collect the mature pollen. The mature pollen is immediately frozen in liquid nitrogen containers and the pollen is crushed. The harvested tissue is then stored at -80°C until RNA preparation.

The CMz033 (Lib189) cDNA library is generated from maize pooled leaf tissue. Samples are harvested from open pollinated plants. Tissue is collected from maize leaves at the anthesis stage. The leaves are collected from 10-12 plants and frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The CMz034 (Lib3060) cDNA library is generated from maize mature tissue at 40 days post pollination plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected from leaves located two leaves below the ear leaf. This sample represents those genes expressed during onset and early stages of leaf senescence. The leaves are pooled and immediately transferred to liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The CMz035 (Lib3061) cDNA library is generated from maize endosperm tissue at the V10+ plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime

temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected from V10+ stage plants. The ear shoots, which are ready for fertilization, are enclosed in a paper bag prior to silk emergence to withhold pollen. Thirty-two days after pollination, the ears are pulled out and the kernels are removed from the cob. Each kernel is dissected into the embryo and the endosperm and the aleurone layer is removed. After dissection, the endosperms are immediately transferred to liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The CMz036 (Lib3062) cDNA library is generated from maize husk tissue at the 8 week old plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected from 8 week old plants. The husk is separated from the ear and immediately transferred to liquid nitrogen containers. The harvested tissue is then stored at -80°C until RNA preparation.



The CMz037 (Lib3059) cDNA library is generated from maize pooled kernal at 12-15 days after pollination plant development stage. Sample were collected from field grown material. Whole kernels from hand pollinated (control pollination) are harvested as whole ears and immediately frozen on dry ice. Kernels from 10-12 ears were pooled and ground together in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The CMz039 (Lib3066) cDNA library is generated from maize immature anther tissue at the 7 week old immature tassel stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the 7 week old immature tassel stage. At this stage, prior to anthesis, the immature anthers are green and enclosed in the staminate spikelet. The developing anthers are dissected away from the 7 week old immature tassel and immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The CMz040 (Lib3067) cDNA library is generated from maize kernel tissue at the V10+ plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into

10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected from V10+ stage plants. The ear shoots, which are ready for fertilization, are enclosed in a paper bag before silk emergence to withhold pollen. Five to eight days after controlled pollination. The ears are pulled and the kernels removed. The kernels are immediately frozen in liquid nitrogen. The harvested kernels tissue is then stored at -80°C until RNA preparation. This sample represents gene expressed in early kernel development, during periods of cell division, amyloplast biogenesis and early carbon flow across the material to filial tissue.

The CMz041 (Lib3068) cDNA library is generated from maize pollen germinating silk tissue at the V10+ plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F.



Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected from V10+ stage plants when the ear shoots are ready for fertilization at the silk emergence stage. The emerging silks are pollinated with an excess of pollen under controlled pollination conditions in the green house. Eighteen hours after pollination the silks are removed from the ears and immediately frozen in liquid nitrogen containers. This sample represents genes expressed in both pollen and silk tissue early in pollination. The harvested tissue is then stored at -80°C until RNA preparation.

The CMz042 (Lib3069) cDNA library is generated from maize ear tissue excessively pollinated at the V10+ plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F.

Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected from V10+ stage plants and the ear shoots which are ready for fertilization are at the silk emergence stage. The immature ears are pollinated with an excess of pollen under controlled pollination conditions. Eighteen hours post-pollination, the ears are removed and immediately transferred to liquid nitrogen containers. The harvested tissue is then stored at -80°C until RNA preparation.



The CMz044 (Lib3075) cDNA library is generated from maize microspore tissue at the V10+ plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected from immature anthers from 7 week old tassels. The immature anthers are first dissected from the 7 week old tassel with a scalpel on a glass slide covered with water. The microspores (immature pollen) are released into the water and are recovered by centrifugation. The microspore suspension is immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The CMz045 (Lib3076) cDNA library is generated from maize immature ear megaspore tissue. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are



grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected from immature ear (megaspore) obtained from 7 week old plants. The immature ears are harvested from the 7 week old plants and are approximately 2.5 to 3 cm in length. The kernels are removed from the cob immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The CMz047 (Lib3078) cDNA library is generated from maize CO₂ treated high-exposure shoot tissue at the V10+ plant development stage. RX601 maize seeds are sterilized for 1 minute with a 10% clorox solution. The seeds are rolled in germination paper, and germinated in 0.5 mM calcium sulfate solution for two days at 30°C. The seedlings are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium at a rate of 2-3 seedlings per pot. Twenty pots are placed into a high CO₂ environment (approximately 1000 ppm CO₂). Twenty plants were grown under ambient greenhouse CO₂ (approximately 450 ppm CO₂). Plants are watered daily before transplantation and three times a week after transplantation. Peters 20-20-20 fertilizer is also lightly applied. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. At ten days post planting, the shoots from both atmosphere are frozen in liquid nitrogen and lightly ground. The roots are washed in deionized water to remove the support media and the tissue is immediately transferred to liquid nitrogen containers. The harvested tissue is then stored at -80°C until RNA preparation.

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The CMz048 (Lib3079) cDNA library is generated from maize basal endosperm transfer layer tissue at the V10+ plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected from V10+ maize plants. The ear shoots, which are ready for fertilization, are enclosed in a paper bag prior to silk emergence, to withhold the pollen. Kernels are harvested at 12 days post-pollination and placed on wet ice for dissection. The kernels are cross sectioned laterally, dissecting just above the pedicel region, including 1-2 mm of the lower endosperm and the basal endosperm transfer region. The pedicel and lower endosperm region containing the basal endosperm transfer layer is pooled and immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The CMz049(Lib3088) cDNA library is generated from maize immature anther tissue at the 7 week old immature tassel stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is

applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is at the 7 week old immature tassel stage. At this stage, prior to anthesis, the immature anthers are green and enclosed in the staminate spikelet. The developing anthers are dissected away from the 7 week old immature tassel and immediately transferred to liquid nitrogen container. The harvested tissue is then stored at -80°C until RNA preparation.

The CMz050 (Lib3114) cDNA library is generated from maize silk tissue at the V10+ plant development stage. Seeds are planted at a depth of approximately 3 cm into 2-3 inch peat pots containing Metro 200 growing medium. After 2-3 weeks growth they are transplanted into 10 inch pots containing the same growing medium. Plants are watered daily before transplantation and three times a week after transplantation. Peters 15-16-17 fertilizer is applied three times per week after transplanting at a strength of 150 ppm N. Two to three times during the lifetime of the plant, from transplanting to flowering, a total of 900 mg Fe is added to each pot. Maize plants are grown in the greenhouse in 15 hr day/9 hr night cycles. The daytime temperature is approximately 80°F and the nighttime temperature is approximately 70°F. Supplemental lighting is provided by 1000 W sodium vapor lamps. Tissue is collected when the maize plant is beyond the 10-leaf development stage and the ear shoots are approximately 15-20 cm in length. The ears are pulled and silks are separated from the ears and immediately

transferred to liquid nitrogen containers. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON001 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) total leaf tissue at the V4 plant development stage. Leaf tissue from 38, field grown V4 stage plants is harvested from the 4th node. Leaf tissue is removed from the plants and immediately frozen in dry-ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON002 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) root tissue at the V4 plant development stage. Root tissue from 76, field grown V4 stage plants is harvested. The root systems is cut from the soybean plant and washed with water to free it from the soil and immediately frozen in dry-ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON003 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) seedling hypocotyl axis tissue harvested 2 day post-imbibition. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium. Trays are placed in an environmental chamber and grown at 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature approximately 24°C. Soil is checked and watered daily to maintain even moisture conditions. Tissue is collected 2 days after the start of imbibition. The 2 days after imbibition samples are separated into 3 collections after removal of any adhering seed coat. At the 2 day stage, the hypocotyl axis is emerging from the soil. A few seedlings have cracked the soil surface and exhibited slight greening of the exposed cotyledons. The seedlings are washed

in water to remove soil, hypocotyl axis harvested and immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON004 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) seedling cotyledon tissue harvested 2 day post-imbibition. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium. Trays are placed in an environmental chamber and grown at 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature approximately 24°C. Soil is checked and watered daily to maintain even moisture conditions. Tissue is collected 2 days after the start of imbibition. The 2 days after imbibition samples are separated into 3 collections after removal of any adhering seed coat. At the 2 day stage, the hypocotyl axis is emerging from the soil. A few seedlings have cracked the soil surface and exhibited slight greening of the exposed cotyledons. The seedlings are washed in water to remove soil, hypocotyl axis harvested and immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON005 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) seedling hypocotyl axis tissue harvested 6 hour post-imbibition. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium. Trays are placed in an environmental chamber and grown at 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature approximately 24°C. Soil is checked and watered daily to maintain even moisture conditions. Tissue is collected 6 hours after the start of imbibition. The 6 hours after imbibition samples are separated into 3 collections after removal of any adhering seed coat. The 6 hours after imbibition sample is collected over the course of approximately 2 hours starting at 6

hours post imbibition. At the 6 hours after imbibition stage, not all cotyledons have become fully hydrated and germination, or radicle protrusion, has not occurred. The seedlings are washed in water to remove soil, hypocotyl axis harvested and immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON006 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) seedling cotyledons tissue harvest 6 hour post-imbibition. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium. Trays are placed in an environmental chamber and grown at 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature approximately 24°C. Soil is checked and watered daily to maintain even moisture conditions. Tissue is collected 6 hours after imbibition. The 6 hours after imbibition samples are separated into 3 collections after removal of any adhering seed coat. The 6 hours after imbibition sample is collected over the course of approximately 2 hours starting at 6 hours post-imbibition. At the 6 hours after imbibition, not all cotyledons have become fully hydrated and germination or radicle protrusion, have not occurred. The seedlings are washed in water to remove soil, cotyledon harvested and immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON007 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) seed tissue harvested 25 and 35 days post-flowering. Seed pods from field grown plants are harvested 25 and 35 days after flowering and the seeds extracted from the pods. Approximately 4.4g and 19.3g of seeds are harvested from the respective seed pods and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON008 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) leaf tissue harvested from 25 and 35 days post-flowering plants. Total leaf tissue is harvested from field grown plants. Approximately 19g and 29g of leaves are harvested from the fourth node of the plant 25 and 35 days post-flowering and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON009 cDNA library is generated from soybean cutlivar C1944 (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.) pod and seed tissue harvested 15 days post-flowering. Pods from field grown plants are harvested 15 days post-flowering. Approximately 3g of pod tissue is harvested and immediately frozen in dry-ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON010 cDNA library is generated from soybean cultivar C1944 (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.) seed tissue harvested 40 days post-flowering. Pods from field grown plants are harvested 40 days post-flowering. Pods and seeds are separated, approximately 19g of seed tissue is harvested and immediately frozen in dry-ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON011 cDNA library is generated from soybean cultivars Cristalina (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.) and FT108 (Monsoy, Brazil) (tropical germ plasma) leaf tissue. Leaves are harvested from plants grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature approximately 24°C. Soil is checked and watered daily to maintain even moisture conditions. Approximately 30g of leaves are harvested from the 4th node of each

of the Cristalina and FT108 cultivars and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON012 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) leaf tissue. Leaves from field grown plants are harvested from the fourth node 15 days post-flowering. Approximately 12g of leaves are harvested and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON013 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) root and nodule tissue. Approximately, 28g of root tissue from field grown plants is harvested 15 days post-flowering. The root system is cut from the soybean plant, washed with water to free it from the soil and immediately frozen in dry-ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON014 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) seed tissue harvested 25 and 35 days after flowering. Seed pods from field grown plants are harvested 15 days after flowering and the seeds extracted from the pods. Approximately 5g of seeds are harvested from the respective seed pods and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON015 cDNA is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) seed tissue harvested 45 and 55 days post-flowering. Seed pods from field grown plants are harvested 45 and 55 days after flowering and the seeds extracted from the pods. Approximately 19g and 31g of seeds are harvested from the respective

seed pods and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON016 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) root tissue. Approximately, 61g and 38g of root tissue from field grown plants is harvested 25 and 35 days post- flowering is harvested. The root system is cut from the soybean plant and washed with water to free it from the soil. The tissue is placed in 14ml polystyrene tubes and immediately frozen in dry-ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON017 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) root tissue. Approximately 28g of root tissue from field grown plants is harvested 45 and 55 days post-flowering. The root system is cut from the soybean plant, washed with water to free it from the soil and immediately frozen in dry-ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON018 cDNA is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) leaf tissue harvested 45 and 55 days post-flowering. Leaves from field grown plants are harvested 45 and 55 days after flowering from the fourth node. Approximately 27g and 33g of seeds are harvested from the respective seed pods and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON019 cDNA library is generated from soybean cultivars Cristalina (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.) and FT108 (Monsoy, Brazil) (tropical germ plasma) root tissue. Roots are harvested from plants grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and

the nighttime temperature approximately 24°C. Soil is checked and watered daily to maintain even moisture conditions. Approximately 50g and 56g of roots are harvested from each of the Cristalina and FT108 cultivars and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON020 cDNA is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) seed tissue harvested 65 and 75 days post-flowering. Seed pods from field grown plants are harvested 45 and 55 days after flowering and the seeds extracted from the pods. Approximately 14g and 31g of seeds are harvested from the respective seed pods and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON021 cDNA library is generated from Soybean Cyst Nematode-resistant soybean cultivar Hartwig (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.) root tissue. Plants are grown in tissue culture at room temperature. At approximately 6 weeks post-germination, the plants are exposed to sterilized Soybean Cyst Nematode eggs. Infection is then allowed to progress for 10 days. After the 10 day infection process, the tissue is harvested. Agar from the culture medium and nematodes are removed and the root tissue is immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON022 (Lib3030) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) partially opened flower tissue. Partially to fully opened flower tissue is harvested from plants grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature approximately 24°C. Soil is checked and watered daily to

maintain even moisture conditions. A total of 3g of flower tissue is harvested and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON023 cDNA library is generated from soybean genotype BW211S Null (Tohoku University, Morioka, Japan) seed tissue harvested 15 and 40 days post-flowering. Seed pods from field grown plants are harvested 15 and 40 days post-flowering and the seeds extracted from the pods. Approximately 0.7g and 14.2g of seeds are harvested from the respective seed pods and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON024 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) internode-2 tissue harvested 18 days post-imbibition. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium. The plants are grown in a greenhouse for 18 days after the start of imbibition at ambient temperature. Soil is checked and watered daily to maintain even moisture conditions. Stem tissue is harvested 18 days after the start of imbibition. The samples are divided into hypocotyl and internodes 1 through 5. The fifth internode contains some leaf bud material. Approximately 3 g of each sample is harvested and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON025 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) leaf tissue harvested 65 days post-flowering. Leaves are harvested from the fourth node of field grown plants 65 days post-flowering. Approximately 18.4g of leaf tissue is harvested and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

SOYMON026 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) root tissue harvested 65 and 75 days post-flowering. Approximately 27g and 40g of root tissue from field grown plants is harvested 65 and 75 days post-flowering. The root system is cut from the soybean plant, washed with water to free it from the soil and immediately frozen in dry-ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON027 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) seed tissue harvested 25 days post-flowering. Seed pods from field grown plants are harvested 25 days post-flowering and the seeds extracted from the pods. Approximately 17g of seeds are harvested from the seed pods and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON028 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) drought-stressed root tissue. The plants are grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature 24°C. Soil is checked and watered daily to maintain even moisture conditions. At the R3 stage of development, water is withheld from half of the plant collection (drought stressed population). After 3 days, half of the plants from the drought stressed condition and half of the plants from the control population are harvested. After another 3 days (6 days post drought induction) the remaining plants are harvested. A total of 27g and 40g of root tissue is harvested and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON029 cDNA library is generated from Soybean Cyst Nematode-resistant soybean cultivar PI07354 (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.) root tissue. Late fall to early winter greenhouse grown plants are exposed to Soybean Cyst Nematode eggs. At 10 days post-infection, the plants are uprooted, rinsed briefly and the roots frozen in liquid nitrogen. Approximately 20 grams of root tissue is harvested from the infected plants. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON030 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) flower bud tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature approximately 24°C. Soil is checked and watered daily to maintain even moisture conditions. Flower buds are removed from the plant at the pedicel. A total of 100mg of flower buds are harvested and immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON031 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) carpel and stamen tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature approximately 24°C. Soil is checked and watered daily to maintain even moisture conditions. Flower buds are removed from the plant at the pedicel. Flowers are dissected to separate petals, sepals and reproductive structures (carpels and stamens). A total of 300mg of carpel and stamen tissue are

harvested and immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON032 cDNA library is prepared from the Asgrow cultivar A4922 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) rehydrated dry soybean seed meristem tissue. Surface sterilized seeds are germinated in liquid media for 24 hours. The seed axis is then excised from the barely germinating seed, placed on tissue culture media and incubated overnight at 20°C in the dark. The supportive tissue is removed from the explant prior to harvest. Approximately 570mg of tissue is harvested and frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON033 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) heat-shocked seedling tissue without cotyledons. Seeds are imbibed and germinated in vermiculite for 2 days under constant illumination. After 48 hours, the seedlings are transferred to an incubator set at 40°C under constant illumination. After 30, 60 and 180 minutes seedlings are harvested and dissected. A portion of the seedling consisting of the root, hypocotyl and apical hook is frozen in liquid nitrogen and stored at -80°C. The seedlings after 2 days of imbibition are beginning to emerge from the vermiculite surface. The apical hooks are dark green in appearance. Total RNA and poly A⁺ RNA is prepared from equal amounts of pooled tissue.

The SOYMON034 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) cold-shocked seedling tissue without cotyledons. Seeds are imbibed and germinated in vermiculite for 2 days under constant illumination. After 48 hours, the seedlings are transferred to a cold room set at 5°C under constant illumination. After 30, 60 and 180 minutes seedlings are harvested and dissected. A

portion of the seedling consisting of the root, hypocotyl and apical hook is frozen in liquid nitrogen and stored at -80°C. The seedlings after 2 days of imbibition are beginning to emerge from the vermiculite surface. The apical hooks are dark green in appearance.

The SOYMON035 cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) seed coat tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature 24°C. Soil is checked and watered daily to maintain even moisture conditions. Seeds are harvested from mid to nearly full maturation (seed coats are not yellowing). The entire embryo proper is removed from the seed coat sample and the seed coat tissue are harvested and immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON036 cDNA library is generated from soybean cultivars PI171451, PI227687 and PI229358 (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.) insect challenged leaves. Plants from each of the three cultivars are grown in screenhouse conditions. The screenhouse is divided in half and one half of the screenhouse is infested with soybean looper and the other half infested with velvetbean caterpillar. A single leaf is taken from each of the representative plants at 3 different time points, 11 days after infestation, 2 weeks after infestation and 5 weeks after infestation and immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation. Total RNA and poly A⁺ RNA is isolated from pooled tissue consisting of equal quantities of all 18 samples (3 genotypes X 3 sample times X 2 insect genotypes).

The SOYMON037 cDNA library is generated from soybean cultivar A3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) etiolated axis and radical tissue. Seeds are planted in moist vermiculite, wrapped and kept at room temperature in complete darkness until harvest. Etiolated axis and hypocotyl tissue is harvested at 2, 3 and 4 days post-planting. A total of 1 gram of each tissue type is harvested at 2, 3 and 4 days after planting and immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The SOYMON038 cDNA library is generated from soybean variety Asgrow A3237 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) rehydrated dry seeds. Explants are prepared for transformation after germination of surface-sterilized seeds on solid tissue media. After 6 days, at 28°C and 18 hours of light per day, the germinated seeds are cold shocked at 4°C for 24 hours. Meristemic tissue and part of the hypocotyl is removed and cotyledon excised. The prepared explant is then wounded for *Agrobacterium* infection. The 2 grams of harvested tissue is frozen in liquid nitrogen and stored at -80°C until RNA preparation.

The Soy51 (LIB3027) cDNA library is prepared from equal amounts tissue harvested from SOYMON007, SOYMON015 and SOYMON020 prepared tissue. Single stranded and double stranded DNA representing approximately 1×10^6 colony forming units are isolated using standard protocols. RNA, complementary to the single stranded DNA, is synthesized using the double stranded DNA as a template. Biotinylated dATP is incorporated into the RNA during the synthesis reaction. The single stranded DNA is mixed with the biotinylated RNA in a 1:10 molar ratio) and allowed to hybridize. DNA-RNA hybrids are captured on Dynabeads M280 streptavidin (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The dynabeads with captured hybrids are collected with a magnet. The non-hybridized single

stranded molecules remaining after hybrid capture are converted to double stranded form and represent the primary normalized library.

The Soy52 (LIB3028) cDNA library is generated from normalized flower DNA. Single stranded DNA representing approximately 1×10^6 colony forming units of SOYMON022 harvested tissue is used as the starting material for normalization. RNA, complementary to the single stranded DNA, is synthesized using the double stranded DNA as a template. Biotinylated dATP is incorporated into the RNA during the synthesis reaction. The single stranded DNA is mixed with the biotinylated RNA in a 1:10 molar ratio) and allowed to hybridize. DNA-RNA hybrids are captured on Dynabeads M280 streptavidin (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The dynabeads with captured hybrids are collected with a magnet. The non-hybridized single stranded molecules remaining after hybrid capture are converted to double stranded form and represent the primary normalized library.

The Soy53 (LIB3039) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) seedling shoot apical meristem tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature 24°C. Soil is checked and watered daily to maintain even moisture conditions. Apical tissue is harvested from seedling shoot meristem tissue, 7-8 days after the start of imbibition. The apex of each seedling is dissected to include the fifth node to the apical meristem. The fifth node corresponds to the third trifoliate leaf in the very early stages of development. Stipules completely envelop the leaf primordia at this time. A total of 200mg of apical tissue is harvested

and immediately frozen in liquid nitrogen. The harvested tissue is then stored at -80°C until RNA preparation.

The Soy54 (LIB3040) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) heart to torpedo stage embryo tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature 24°C. Soil is checked and watered daily to maintain even moisture conditions. Seeds are collected and embryos removed from surrounding endosperm and maternal tissues. Embryos from globular to young torpedo stages (by corresponding analogy to *Arabidopsis*) are collected with a bias towards the middle of this spectrum. Embryos which are beginning to show asymmetric development of cotyledons are considered the upper developmental boundary for the collection and are excluded. A total of 12 mg embryo tissue is frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA preparation.

Soy55 (LIB3049) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) young seed tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature 24°C. Soil is checked and watered daily to maintain even moisture conditions. Seeds are collected from very young pods (5 to 15 days after flowering). A total of 100mg of seeds are harvested and frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA preparation.

Soy56 (LIB3029) cDNA library is prepared from equal amounts tissue harvested from SOYMON007, SOYMON015 and SOYMON020 prepared tissue. Single stranded and double stranded DNA representing approximately 1×10^6 colony forming units are isolated using standard protocols. RNA, complementary to the single stranded DNA, is synthesized using the double stranded DNA as a template. Biotinylated dATP is incorporated into the RNA during the synthesis reaction. The single stranded DNA is mixed with the biotinylated RNA in a 1:10 molar ratio and allowed to hybridize. DNA-RNA hybrids are captured on Dynabeads M280 streptavidin (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The dynabeads with captured hybrids are collected with a magnet. The non-hybridized single stranded molecules remaining after hybrid capture are not converted to double stranded form and represent a non-normalized seed pool for comparison to Soy51 cDNA libraries.

TheSoy58 (LIB3050) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) drought stressed root tissue subtracted from control root tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature 24°C. Soil is checked and watered daily to maintain even moisture conditions. At the R3 stage of the plant drought is induced by withholding water. After 3 and 6 days root tissue from both drought stressed and control (watered regularly) plants are collected and frozen in dry-ice. The harvested tissue is stored at -80°C until RNA preparation. For subtraction, target cDNA is made from the drought stressed tissue total RNA using the SMART cDNA synthesis system from Clontech (Clontech Laboratories, Palo Alto, California U.S.A.). Driver first strand cDNA is covalently linked to Dynabeads following a protocol similar to that

described in the Dynal literature (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The target cDNA is then heat denatured and the second strand trapped using Dynabeads oligo-dT. The target second strand cDNA is then hybridized to the driver cDNA in 400µl 2X SSPE for two rounds of hybridization at 65°C and 20 hours. After each hybridization, the hybridization solution is removed from the system and the hybridized target cDNA removed from the driver by heat denaturation in water. After hybridization, the remaining cDNA is trapped with Dynabeads oligo-dT. The trapped cDNA is then amplified as in previous PCR based libraries and the resulting cDNA ligated into the pSPORT vector (Invitrogen, Carlsbad California U.S.A.).

The Soy59 (LIB3051) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) endosperm tissue. Seeds are germinated on paper towels under laboratory ambient light conditions. At 8, 10 and 14 hours after imbibition, the seed coats are harvested. The endosperm consists of a very thin layer of tissue affixed to the inside of the seed coat. The seed coat and endosperm are frozen immediately after harvest in liquid nitrogen. The harvested tissue is stored at -80°C until RNA preparation.

The Soy60 (LIB3072) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) drought stressed seed plus pod subtracted from control seed plus pod tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 26°C and the nighttime temperature 21°C and 70% relative humidity. Soil is checked and watered daily to maintain even moisture conditions. At the R3 stage of the plant drought is induced by withholding water. After 3 and 6 days seeds and pods from both drought stressed and

control (watered regularly) plants are collected from the fifth and sixth node and frozen in dry-ice. The harvested tissue is stored at -80°C until RNA preparation. For subtraction, target cDNA is made from the drought stressed tissue total RNA using the SMART cDNA synthesis system from Clontech (Clontech Laboratories, Palo Alto, California U.S.A.). Driver first strand cDNA is covalently linked to Dynabeads following a protocol similar to that described in the Dynal literature (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The target cDNA is then heat denatured and the second strand trapped using Dynabeads oligo-dT. The target second strand cDNA is then hybridized to the driver cDNA in $400\ \mu\text{l}$ 2X SSPE for two rounds of hybridization at 65°C and 20 hours. After each hybridization, the hybridization solution is removed from the system and the hybridized target cDNA removed from the driver by heat denaturation in water. After hybridization, the remaining cDNA is trapped with Dynabeads oligo-dT. The trapped cDNA is then amplified as in previous PCR based libraries and the resulting cDNA ligated into the pSPORT vector (Invitrogen, Carlsbad California U.S.A.).

The Soy61 (LIB3073) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) jasmonic acid treated seedling subtracted from control tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in a greenhouse. The daytime temperature is approximately 29.4°C and the nighttime temperature 20°C . Soil is checked and watered daily to maintain even moisture conditions. At 9 days post planting, the plantlets are sprayed with either control buffer of 0.1% Tween-20 or jasmonic acid (Sigma J-2500, Sigma, St. Louis, Missouri U.S.A.) at 1 mg/ml in 0.1% Tween-20. Plants are sprayed until runoff and the soil and the stem is soaked with the spraying solution. At 18 hours post application of jasmonic acid, the soybean plantlets appear growth retarded. After 18hours, 24hours and 48 hours post

treatment, the cotyledons are removed and the remaining leaf and stem tissue above the soil is harvested and frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA preparation. To make RNA, the three sample timepoints were combined and ground. For subtraction, target cDNA is made from the jasmonic acid treated tissue total RNA using the SMART cDNA synthesis system from Clontech (Clontech Laboratories, Palo Alto, California U.S.A.). Driver first strand cDNA is covalently linked to Dynabeads following a protocol similar to that described in the Dynal literature (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The target cDNA is then heat denatured and the second strand trapped using Dynabeads oligo-dT. The target second strand cDNA is then hybridized to the driver cDNA in 400 µl 2X SSPE for two rounds of hybridization at 65°C and 20 hours. After each hybridization, the hybridization solution is removed from the system and the hybridized target cDNA removed from the driver by heat denaturation in water. After hybridization, the remaining cDNA is trapped with Dynabeads oligo-dT. The trapped cDNA is then amplified as in previous PCR based libraries and the resulting cDNA ligated into the pSPORT vector (Invitrogen, Carlsbad California U.S.A.). For this library's construction, the eighth fraction of the cDNA size fractionation step was used for ligation.

The Soy62 (LIB3074) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) jasmonic acid treated seedling subtracted from control tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in a greenhouse. The daytime temperature is approximately 29.4°C and the nighttime temperature 20°C. Soil is checked and watered daily to maintain even moisture conditions. At 9 days post planting, the plantlets are sprayed with either control buffer of 0.1% Tween-20 or jasmonic acid (Sigma J-2500, Sigma, St.

Loius, Missouri U.S.A.) at 1 mg/ml in 0.1% Tween-20. Plants are sprayed until runoff and the soil and the stem is soaked with the spraying solution. At 18 hours post application of jasmonic acid, the soybean plantlets appear growth retarded. After 18 hours, 24 hours and 48 hours post treatment, the cotyledons are removed and the remaining leaf and stem tissue above the soil is harvested and frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA preparation. To make RNA, the three sample timepoints were combined and ground. For subtraction, target cDNA is made from the jasmonic acid treated tissue total RNA using the SMART cDNA synthesis system from Clontech (Clontech Laboratories, Palo Alto, California U.S.A.). Driver first strand cDNA is covalently linked to Dynabeads following a protocol similar to that described in the Dynal literature (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The target cDNA is then heat denatured and the second strand trapped using Dynabeads oligo-dT. The target second strand cDNA is then hybridized to the driver cDNA in 400 µl 2X SSPE for two rounds of hybridization at 65°C and 20 hours. After each hybridization, the hybridization solution is removed from the system and the hybridized target cDNA removed from the driver by heat denaturation in water. After hybridization, the remaining cDNA is trapped with Dynabeads oligo-dT. The trapped cDNA is then amplified as in previous PCR based libraries and the resulting cDNA ligated into the pSPORT vector (Invitrogen, Carlsbad California U.S.A.). For this library's construction, the ninth fraction of the cDNA size fractionation step was used for ligation.

The Soy65 (LIB3107) 07cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) drought-stressed abscission zone tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in an environmental chamber under 12hr daytime/12hr

nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature 24°C. Soil is checked and watered daily to maintain even moisture conditions. Plants are irrigated with 15-16-17 Peter's Mix. At the R3 stage of development, drought is imposed by withholding water. At 3, 4, 5 and 6 days, tissue is harvested and wilting is not obvious until the fourth day. Abscission layers from reproductive organs are harvested by cutting less than one millimeter proximal and distal to the layer and immediately frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA preparation.

The Soy66 (LIB3109) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) non-drought stressed abscission zone tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature approximately 24°C. Soil is checked and watered daily to maintain even moisture conditions. Plants are irrigated with 15-16-17 Peter's Mix. At 3, 4, 5 and 6 days, control abscission layer tissue is harvested. Abscission layers from reproductive organs are harvested by cutting less than one millimeter proximal and distal to the layer and immediately frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA preparation.

Soy67 (LIB3065) cDNA library is prepared from equal amounts tissue harvested from SOYMON007, SOYMON015 and SOYMON020 prepared tissue. Single stranded and double stranded DNA representing approximately 1×10^6 colony forming units are isolated using standard protocols. RNA, complementary to the single stranded DNA, is synthesized using the double stranded DNA as a template. Biotinylated dATP is incorporated into the RNA during the synthesis reaction. The single stranded DNA is mixed with the biotinylated RNA in a 1:10 molar

ratio) and allowed to hybridize. DNA-RNA hybrids are captured on Dynabeads M280 streptavidin (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The dynabeads with captured hybrids are collected with a magnet. Captured hybrids are eluted with water.

Soy68 (LIB3052) cDNA library is prepared from equal amounts tissue harvested from SOYMON007, SOYMON015 and SOYMON020 prepared tissue. Single stranded and double stranded DNA representing approximately 1×10^6 colony forming units are isolated using standard protocols. RNA, complementary to the single stranded DNA, is synthesized using the double stranded DNA as a template. Biotinylated dATP is incorporated into the RNA during the synthesis reaction. The single stranded DNA is mixed with the biotinylated RNA in a 1:10 molar ratio) and allowed to hybridize. DNA-RNA hybrids are captured on Dynabeads M280 streptavidin (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The dynabeads with captured hybrids are collected with a magnet. Captured hybrids are eluted with water.

Soy69 (LIB3053) cDNA library is generated from soybean cultivars Cristalina (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.) and FT108 (Monsoy, Brazil) (tropical germ plasma) normalized leaf tissue. Leaves are harvested from plants grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature approximately 24°C. Soil is checked and watered daily to maintain even moisture conditions. Approximately 30g of leaves are harvested from the 4th node of each of the Cristalina and FT108 cultivars and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation. Single stranded and double stranded DNA representing approximately 1×10^6 colony forming units are isolated using standard protocols. RNA, complementary to the single stranded DNA, is synthesized using the double stranded DNA as a template. Biotinylated dATP is incorporated into the RNA during the

synthesis reaction. The single stranded DNA is mixed with the biotinylated RNA in a 1:10 molar ratio) and allowed to hybridize. DNA-RNA hybrids are captured on Dynabeads M280 streptavidin (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The dynabeads with captured hybrids are collected with a magnet. The non-hybridized single stranded molecules remaining after hybrid capture are converted to double stranded form and represent the primary normalized library.

Soy70 (LIB3055) cDNA library is generated from soybean cultivars Cristalina (USDA Soybean Germplasm Collection, Urbana, Illinois U.S.A.) and FT108 (Monsoy, Brazil) (tropical germ plasma) leaf tissue. Leaves are harvested from plants grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature approximately 24°C. Soil is checked and watered daily to maintain even moisture conditions. Approximately 30g of leaves are harvested from the 4th node of each of the Cristalina and FT108 cultivars and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

Soy71 (LIB3056) cDNA library is generated from soybean cultivars Cristalina and FT108 (tropical germ plasma) root tissue. Roots are harvested from plants grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 29°C and the nighttime temperature approximately 24°C. Soil is checked and watered daily to maintain even moisture conditions. Approximately 50g and 56g of roots are harvested from each of the Cristalina and FT108 cultivars and immediately frozen in dry ice. The harvested tissue is then stored at -80°C until RNA preparation.

Soy72 (LIB3093) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) drought stressed leaf control tissue. Seeds

are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in an environmental chamber under 12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 26°C and the nighttime temperature 21°C and 70% relative humidity. Soil is checked and watered daily to maintain even moisture conditions. At the R3 stage of the plant drought is induced by withholding water. After 3 and 6 days seeds and pods from both drought stressed and control (watered regularly) plants are collected from the fifth and sixth node and frozen in dry-ice. The harvested tissue is stored at -80°C until RNA preparation. For subtraction, target cDNA is made from the drought stressed tissue total RNA using the SMART cDNA synthesis system from Clontech (Clontech Laboratories, Palo Alto, California U.S.A.). Driver first strand cDNA is covalently linked to Dynabeads following a protocol similar to that described in the Dynal literature (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The target cDNA is then heat denatured and the second strand trapped using Dynabeads oligo-dT. The target second strand cDNA is then hybridized to the driver cDNA in 400 µl 2X SSPE for two rounds of hybridization at 65°C and 20 hours. After each hybridization, the hybridization solution is removed from the system and the hybridized target cDNA removed from the driver by heat denaturation in water. After hybridization, the remaining cDNA is trapped with Dynabeads oligo-dT. The trapped cDNA is then amplified as in previous PCR based libraries and the resulting cDNA ligated into the pSPORT vector (Invitrogen, Carlsbad California U.S.A.).

Soy73 (LIB3093) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) drought stressed leaf subtracted from control tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in an environmental chamber under

12hr daytime/12hr nighttime cycles. The daytime temperature is approximately 26°C and the nighttime temperature 21°C and 70% relative humidity. Soil is checked and watered daily to maintain even moisture conditions. At the R3 stage of the plant drought is induced by withholding water. After 3 and 6 days seeds and pods from both drought stressed and control (watered regularly) plants are collected from the fifth and sixth node and frozen in dry-ice. The harvested tissue is stored at -80°C until RNA preparation. For subtraction, target cDNA is made from the drought stressed tissue total RNA using the SMART cDNA synthesis system from Clontech (Clontech Laboratories, Palo Alto, California U.S.A.). Driver first strand cDNA is covalently linked to Dynabeads following a protocol similar to that described in the Dynal literature (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The target cDNA is then heat denatured and the second strand trapped using Dynabeads oligo-dT. The target second strand cDNA is then hybridized to the driver cDNA in 400 µl 2X SSPE for two rounds of hybridization at 65°C and 20 hours. After each hybridization, the hybridization solution is removed from the system and the hybridized target cDNA removed from the driver by heat denaturation in water. After hybridization, the remaining cDNA is trapped with Dynabeads oligo-dT. The trapped cDNA is then amplified as in previous PCR based libraries and the resulting cDNA ligated into the pSPORT vector (Invitrogen, Carlsbad California U.S.A.).

The Soy76 (Lib3106) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) jasmonic acid and arachidonic treated seedling subtracted from control tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in a greenhouse. The daytime temperature is approximately 29.4°C and the nighttime temperature 20°C. Soil is checked and watered daily to maintain even moisture conditions. At 9 days post planting, the

plantlets are sprayed with either control buffer of 0.1% Tween-20 or jasmonic acid (Sigma J-2500, Sigma, St. Louis, Missouri U.S.A.) at 1 mg/ml in 0.1% Tween-20. Plants are sprayed until runoff and the soil and the stem is soaked with the spraying solution. At 18 hours post application of jasmonic acid, the soybean plantlets appear growth retarded. Arachidonic treated seedlings are sprayed with 1m/ml arachidonic acid in 0.1% Tween-20. After 18hours, 24hours and 48 hours post treatment, the cotyledons are removed and the remaining leaf and stem tissue above the soil is harvested and frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA preparation. To make RNA, the three sample timepoints were combined and ground. The RNA from the arachidonic treated seedlings is isolated separately. For subtraction, target cDNA is made from the jasmonic acid treated tissue total RNA using the SMART cDNA synthesis system from Clontech (Clontech Laboratories, Palo Alto, California U.S.A.). Driver first strand cDNA is covalently linked to Dynabeads following a protocol similar to that described in the Dynal literature (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The target cDNA is then heat denatured and the second strand trapped using Dynabeads oligo-dT. The target second strand cDNA is then hybridized to the driver cDNA in 400 µl 2X SSPE for two rounds of hybridization at 65°C and 20 hours. After each hybridization, the hybridization solution is removed from the system and the hybridized target cDNA removed from the driver by heat denaturation in water. After hybridization, the remaining cDNA is trapped with Dynabeads oligo-dT. The trapped cDNA is then amplified as in previous PCR based libraries and the resulting cDNA ligated into the pSPORT vector (Invitrogen, Carlsbad California U.S.A.). Fraction 10 of the size fractionated cDNA is ligated into the pSPORT vector (Invitrogen, Carlsbad California U.S.A.) in order to capture some of the smaller transcripts characteristic of antifungal proteins.

Soy77 (LIB3108) cDNA library is generated from soybean cultivar Asgrow 3244 (Asgrow Seed Company, Des Moines, Iowa U.S.A.) jasmonic acid control tissue. Seeds are planted at a depth of approximately 2cm into 2-3 inch peat pots containing Metromix 350 medium and the plants are grown in a greenhouse. The daytime temperature is approximately 29.4°C and the nighttime temperature 20°C. Soil is checked and watered daily to maintain even moisture conditions. At 9 days post planting, the plantlets are sprayed with either control buffer of 0.1% Tween-20 or jasmonic acid (Sigma J-2500, Sigma, St. Louis, Missouri U.S.A.) at 1 mg/ml in 0.1% Tween-20. Plants are sprayed until runoff and the soil and the stem is soaked with the spraying solution. At 18 hours post application of jasmonic acid, the soybean plantlets appear growth retarded. Arachidonic treated seedlings are sprayed with 1m/ml arachidonic acid in 0.1% Tween-20. After 18 hours, 24 hours and 48 hours post treatment, the cotyledons are removed and the remaining leaf and stem tissue above the soil is harvested and frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA preparation. To make RNA, the three sample timepoints were combined and ground. The RNA from the arachidonic treated seedlings is isolated separately. For subtraction, target cDNA is made from the jasmonic acid treated tissue total RNA using the SMART cDNA synthesis system from Clontech (Clontech Laboratories, Palo Alto, California U.S.A.). Driver first strand cDNA is covalently linked to Dynabeads following a protocol similar to that described in the Dynal literature (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.). The target cDNA is then heat denatured and the second strand trapped using Dynabeads oligo-dT. The target second strand cDNA is then hybridized to the driver cDNA in 400 µl 2X SSPE for two rounds of hybridization at 65°C and 20 hours. After each hybridization, the hybridization solution is removed from the system and the hybridized target cDNA removed from the driver by heat denaturation in water. After

hybridization, the remaining cDNA is trapped with Dynabeads oligo-dT. The trapped cDNA is then amplified as in previous PCR based libraries and the resulting cDNA ligated into the pSPORT vector (Invitrogen, Carlsbad California U.S.A.). Fraction 10 of the size fractionated cDNA is ligated into the pSPORT vector in order to capture some of the smaller transcripts characteristic of antifungal proteins.

The Lib9 cDNA library is prepared from *Arabidopsis thaliana*, Columbia ecotype, leaf tissue. Wild type *Arabidopsis thaliana* seeds are planted in commonly used planting pots and grown in an environmental chamber. Leaf blades were cut with sharp scissors at seven weeks after planting. The tissue was immediately frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA extraction. PolyA mRNA is purified from the total RNA preparation using Dynabeads® Oligo(dT)₂₅ (Dynal Inc., Lake Success, N.Y.), or equivalent methods. This library was normalized using a PCR-based protocol.

The Lib22 cDNA library is prepared from *Arabidopsis thaliana* Columbia ecotype, root tissue. Wild type *Arabidopsis thaliana* seeds are planted in commonly used planting pots and grown in an environmental chamber. After 5-6 weeks the plants are in the reproductive growth phase. Stems are bolting from the base of the plants. After 7 weeks, more stems, floral buds appear, and a few flowers are starting to open. The 7-week old plants are rinsed intensively by tope water remove dirt from the roots, and blotted by paper towel. The tissues are immediately frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA preparation.

The Lib23 cDNA library is prepared from *Arabidopsis thaliana*, Columbia ecotype, stem tissue. Wild type *Arabidopsis thaliana* seeds are planted in commonly used planting pots and grown in an environmental chamber. Stems were collected seven to eight weeks after planting



by cutting the stems from the base and cutting the top of the plant to remove the floral tissue. The tissue was immediately frozen in liquid nitrogen and stored at -80°C until total RNA extraction. PolyA mRNA is purified from the total RNA preparation using Dynabeads® Oligo(dT)₂₅ (Dyna Inc., Lake Success, N.Y.), or equivalent methods. This library was normalized using a PCR-based protocol.

The Lib24 cDNA library is prepared from *Arabidopsis thaliana*, Columbia ecotype, flower bud tissue. Wild type *Arabidopsis thaliana* seeds are planted in commonly used planting pots and grown in an environmental chamber. Flower buds are green and unopened and harvested about seven weeks after planting. The tissue is immediately frozen in liquid nitrogen. The harvested tissue is stored at -80°C until total RNA extraction. PolyA mRNA is purified from the total RNA preparation using Dynabeads® Oligo(dT)₂₅ (Dyna Inc., Lake Success, N.Y.), or equivalent methods. This library was normalized using a PCR-based protocol.

The Lib25 cDNA library is prepared from *Arabidopsis thaliana*, Columbia ecotype, open flower tissue. Wild type *Arabidopsis thaliana* seeds are planted in commonly used planting pots and grown in an environmental chamber. Flowers are completely opened with all parts of floral structure observable, but no siliques are appearing. The tissue was immediately frozen in liquid nitrogen and stored at -80°C until total RNA extraction. PolyA mRNA is purified from the total RNA preparation using Dynabeads® Oligo(dT)₂₅ (Dyna Inc., Lake Success, N.Y.), or equivalent methods. This library was normalized using a PCR-based protocol.

The Lib35 cDNA library of the present invention, was prepared from *Arabidopsis thaliana* Columbia ecotype leaf tissue. Wild type *Arabidopsis thaliana* seeds are planted in commonly used planting pots and grown in an environmental chamber. After 5-6 weeks the

plants are in the reproductive growth phase. Stems are bolting from the base of the plants. After 7 weeks, more stems and floral buds appeared and a few flowers were starting to open. Leaf blades were collected by cutting with sharp scissors. The tissues were immediately frozen in liquid nitrogen and stored at -80°C until use. PolyA mRNA is purified from the total RNA preparation using Dynabeads® Oligo(dT)₂₅ (Dynal Inc., Lake Success, N.Y.), or equivalent methods. This library was normalized using a PCR-based protocol.

The Lib146 cDNA library is prepared from *Arabidopsis thaliana*, Columbia ecotype, immature seed tissue. Wild type *Arabidopsis thaliana* seeds are planted in commonly used planting pots and grown in an environmental chamber. At approximately 7-8 weeks of age, the seeds are harvested. The seeds ranged in maturity from the smallest seeds that could be dissected from silques to just before starting to turn yellow in color. The tissue is immediately frozen in liquid nitrogen. The harvested tissue is stored at -80°C until RNA extraction. PolyA mRNA is purified from the total RNA preparation using Dynabeads® Oligo(dT)₂₅ (Dynal Inc., Lake Success, N.Y.), or equivalent methods. This library is normalized using a PCR-based protocol.

The Lib3032 (Lib80) cDNA libraries are generated from *Brassica napus* seeds harvested 30 days after pollination. The cDNA libraries are constructed using the SuperScript Plasmid system for cDNA synthesis and plasmid cloning (Life Technologies, Gaithersburg, Maryland U.S.A.) according to the manufacturers protocol with the following modification: 40 micrograms of total RNA is used as the starting material for cDNA synthesis, and first strand cDNA synthesis is carried out at 45°C.

The Lib3034 (Lib82) cDNA libraries are generated from *Brassica napus* seeds harvested 15 and 18 days after pollination. The cDNA libraries are constructed using the SuperScript

Plasmid system for cDNA synthesis and plasmid cloning (Life Technologies, Gaithersburg, Maryland U.S.A.) according to the manufacturers protocol with the following modification: 40 micrograms of total RNA is used as the starting material for cDNA synthesis, and first strand cDNA synthesis was carried out at 45°C.

The Lib3099 cDNA library is generated by a subtraction procedure. The library contains cDNAs whose abundance is enriched in the *Brassica napus* 15 and 18 day after pollination seed tissues when compared to *Brassica* leaf tissues. The cDNA synthesis is performed on *Brassica* leaf RNA and *Brassica* RNA isolated from seeds harvested 15 and 18 days after pollination using a Smart PCR cDNA synthesis kit according to the manufacturers protocol (Clontech, Palo Alto, California U.S.A.). The subtracted cDNA is generated using the Clontech PCR-Select subtraction kit according to the manufacturers protocol (Clontech, Palo Alto, California U.S.A.). The subtracted cDNA was cloned into plasmid vector pCR2.1 according to the manufacturers protocol (Invitrogen, Carlsbad, California U.S.A.).

The Lib3033 (Lib81) cDNA libraries are generated from from the *Schizochytrium* species cells. The *Schizochytrium* species cells are grown in liquid media until saturation. The culture is centrifuged to pellet the cells, the medium is decanted off, and pellet immediately frozen in liquid nitrogen. Wax esters are produced under such dark, anaerobic, rich-medium conditions. High wax production by the cultures is verified by microscopy (fluorescein staining of wax bodies) and by lipid extraction/TLC/GC. The harvested cells are stored at -80°C until RNA preparation. RNA is prepared from the frozen *Euglena* cell pellet as follows. The pellet is pulverized to a powder in liquid nitrogen using a mortar and pestle. The powder is transferred to tubes containing 6 ml each of lysis buffer (100 mM Tris, pH 8, 0.6 M NaCl, 10 mM EDTA, and 4% (w/v) SDS) and buffered phenol, vortexed, and disrupted with a Polytron. The mixture is

centrifuged 20 min at 10,000xg in Corex glass tubes to separate the phases. 5 ml of the upper phase is removed, vortexed with 5 ml fresh phenol, and centrifuged. The upper phase is removed and the RNA is precipitated overnight at 4°C by adding 1.5 volumes of 4 M LiCl. The RNA is further purified on Rneasy columns according to the manufacturers protocol (Qiagen, Valencia, California U.S.A.). The cDNA library is constructed using the SuperScript Plasmid system for cDNA synthesis and plasmid cloning (Life Technologies, Gaithersburg, Maryland U.S.A.) according to the manufacturers protocol with the following modification: 40 micrograms of total RNA was used as the starting material for cDNA synthesis, and first strand cDNA synthesis was carried out at 45°C.

The Lib47 cDNA library is generated from *Euglena gracilis* strain 753 (ATTC No. 30285, ATCC Manasas, Virginia U.S.A.) grown in liquid culture. A liquid culture is inoculated with 1/10 volume of a previously-grown saturated culture, and the new culture for 4 days under near-anaerobic conditions (near-anaerobic cultures are not agitated, just gently swirled once a day) in the dark in 2X Beef (10 g/l bacto peptone, 4 g/l yeast extract, 2 g/l beef extract, 6 g/l glucose). The culture is then centrifuged to pellet the cells, the medium is decanted off, and pellet immediately frozen in liquid nitrogen. Wax esters are produced under such dark, anaerobic, rich-medium conditions. High wax production by the cultures is verified by microscopy (fluorescein staining of wax bodies) and by lipid extraction/TLC/GC. The harvested cells are stored at -80°C until RNA preparation. RNA is prepared from the frozen *Euglena* cell pellet as follows. The pellet is pulverized to a powder in liquid nitrogen using a mortar and pestle. The powder is transferred to tubes containing 6 ml each of lysis buffer (100 mM Tris, pH 8, 0.6 M NaCl, 10 mM EDTA, and 4% (w/v) SDS) and buffered phenol, vortexed, and disrupted with a Polytron. The mixture is centrifuged 20 min at 10,000xg in Corex glass tubes to separate

the phases. 5 ml of the upper phase is removed, vortexed with 5 ml fresh phenol, and centrifuged. The upper phase is removed and the RNA is precipitated overnight at 4°C by adding 1.5 volumes of 4 M LiCl. The RNA is further purified on Rneasy columns according to the manufacturers protocol (Qiagen, Valencia, California U.S.A.). The cDNA library is constructed using the SuperScript Plasmid system for cDNA synthesis and plasmid cloning (Life Technologies, Gaithersburg, Maryland U.S.A.) according to the manufacturers protocol with the following modification: 40 micrograms of total RNA was used as the starting material for cDNA synthesis, and first strand cDNA synthesis was carried out at 45°C.

The Lib44 cDNA library is generated from *Phaeodactylum tricornutum* grown in modified Jones medium for 3 days. The cells were harvested by centrifugation and the resulting pellet frozen immediately in liquid nitrogen. The harvested cells are stored at -80°C until RNA preparation. RNA is prepared from the frozen *Phaeodactylum* cell pellet as follows. The pellet is pulverized to a powder in liquid nitrogen using a mortar and pestle. The powder is transferred to tubes containing 6 ml each of lysis buffer (100 mM Tris, pH 8, 0.6 M NaCl, 10 mM EDTA, and 4% (w/v) SDS) and buffered phenol, vortexed, and disrupted with a Polytron. The mixture is centrifuged 20 min at 10,000xg in Corex glass tubes to separate the phases. 5 ml of the upper phase is removed, vortexed with 5 ml fresh phenol, and centrifuged. The upper phase is removed and the RNA is precipitated overnight at 4°C by adding 1.5 volumes of 4 M LiCl. The RNA is further purified on Rneasy columns according to the manufacturers protocol (Qiagen, Valencia, California U.S.A.). The cDNA library is constructed using the SuperScript Plasmid system for cDNA synthesis and plasmid cloning (Life Technologies, Gaithersburg, Maryland U.S.A.) according to the manufacturers protocol with the following modification: 40 micrograms of total

RNA was used as the starting material for cDNA synthesis, and first strand cDNA synthesis was carried out at 45 degrees centigrade.

The LIB3036 genomic library is generated from *Mycobacterium neoaurum* US52 (ATCC No. 23072, ATCC, Manasas, Virginia U.S.A.) cells. *Mycobacterium neoaurum* US52 is a gram-positive Actinomycete bacterium. *Mycobacterium neoaurum* US52 is genetically related to *Mycobacterium tuberculosis*, but there is no reason to believe that it is a primary pathogen. It normally is saprophytic, i.e. it lives in soil and gets nutrients from decaying matter. Genomic DNA obtained from *Mycobacterium neoaurum* US52 is digested for various times with the restriction enzyme Sau3A. The DNA fractions are size-separated on an agarose gel, and the first fraction wherein most of the partially-digested fragments are about 10 kB is used to isolated fragments in the range of 2-3 kB. For LIB3036, the 2-3 kB DNA is cloned into vector pRY401 (Invitrogen, Carlsbad, California U.S.A.). The vector pZERO-2 (Invitrogen, Carlsbad, California U.S.A.). is used for the construction of LIB3104.

The stored RNA is purified using Trizol reagent from Life Technologies (Gibco BRL, Life Technologies, Gaithersburg, Maryland U.S.A.), essentially as recommended by the manufacturer. Poly A+ RNA (mRNA) is purified using magnetic oligo dT beads essentially as recommended by the manufacturer (Dynabeads, Dynal Corporation, Lake Success, New York U.S.A.).

Construction of plant cDNA libraries is well-known in the art and a number of cloning strategies exist. A number of cDNA library construction kits are commercially available. The Superscript™ Plasmid System for cDNA synthesis and Plasmid Cloning (Gibco BRL, Life

Technologies, Gaithersburg, Maryland U.S.A.) is used, following the conditions suggested by the manufacturer.

Normalized libraries are made using essentially the Soares procedure (Soares *et al.*, *Proc. Natl. Acad. Sci. (U.S.A.)* 91:9228-9232 (1994), the entirety of which is herein incorporated by reference). This approach is designed to reduce the initial 10,000-fold variation in individual cDNA frequencies to achieve abundances within one order of magnitude while maintaining the overall sequence complexity of the library. In the normalization process, the prevalence of high-abundance cDNA clones decreases dramatically, clones with mid-level abundance are relatively unaffected and clones for rare transcripts are effectively increased in abundance.

Example 2

The cDNA libraries are plated on LB agar containing the appropriate antibiotics for selection and incubated at 37° for a sufficient time to allow the growth of individual colonies. Single colonies are individually placed in each well of a 96-well microtiter plates containing LB liquid including the selective antibiotics. The plates are incubated overnight at approximately 37°C with gentle shaking to promote growth of the cultures. The plasmid DNA is isolated from each clone using Qiaprep plasmid isolation kits, using the conditions recommended by the manufacturer (Qiagen Inc., Santa Clara, California U.S.A.).

Template plasmid DNA clones are used for subsequent sequencing. For sequencing, the ABI PRISM dRhodamine Terminator Cycle Sequencing Ready Reaction Kit with AmpliTaq® DNA Polymerase, FS, is used (PE Applied Biosystems, Foster City, California U.S.A.).

Example 3

Nucleic acid sequences that encode for the following transcription factors: homeobox transcription factor, HLH transcription factor, leucine zipper transcription factor, zinc finger transcription factor and other transcription factors are identified from the Monsanto EST PhytoSeq database using TBLASTN (default values)(TBLASTN compares a protein query against the six reading frames of a nucleic acid sequence). Matches found with BLAST P values equal or less than 0.001 (probability) or BLAST Score of equal or greater than 90 are classified as hits. If the program used to determine the hit is HMMSW then the score refers to HMMSW score.

In addition, the GenBank database is searched with BLASTN and BLASTX (default values) using ESTs as queries. EST that pass the hit probability threshold of $10e^{-8}$ for the following enzymes are combined with the hits generated by using TBLASTN (described above) and classified by enzyme (see Table A below).

A cluster refers to a set of overlapping clones in the PhytoSeq database. Such an overlapping relationship among clones is designated as a "cluster" when BLAST scores from pairwise sequence comparisons of the member clones meets a predetermined minimum value or product score of 50 or more (Product Score = (BLAST SCORE x Percentage Identity)/(5 x minimum [length (Seq1), length (Seq2)]))

Since clusters are formed on the basis of single-linkage relationships, it is possible for two non-overlapping clones to be members of the same cluster if, for instance, they both overlap a third clone with at least the predetermined minimum BLAST score (stringency). A cluster ID is arbitrarily assigned to all of those clones which belong to the same cluster at a given stringency and a particular clone will belong to only one cluster at a given stringency. If a

TABLE A*

ARABIDOPSIS THALIANA HOMEBOX TRANSCRIPTION FACTORS

Seq No.	Cluster ID	CloneID	Library	NCBI gi	METHOD	Score	P-Value	% Ident
1	2951	LIB24-017-Q1-E1-G11	LIB24	g642128	BLASTN	1335	1e-102	100
2	4472	LIB25-100-Q1-E1-G12	LIB25	g402590	BLASTN	91	1e-17	30
3	4556	LIB24-029-Q1-E1-F4	LIB24	g2506030	BLASTN	1992	1e-157	99
4	4592	LIB24-009-Q1-E1-E10	LIB24	g3096930	BLASTN	77	1e-19	43
5	4649	LIB23-054-Q1-E1-D8	LIB23	g527628	BLASTN	1035	1e-77	100
6	5149	LIB24-096-Q1-E1-C8	LIB24	g1045043	BLASTN	2036	1e-161	99
7	5149	LIB35-035-Q1-E1-B8	LIB35	g1045043	BLASTN	1825	1e-143	100
8	5730	LIB146-010-Q1-E1-F5	LIB146	g1814423	BLASTN	1928	1e-151	99
9	5730	LIB25-074-Q1-E1-F8	LIB25	g1814423	BLASTN	2014	1e-158	99
10	6090	LIB22-076-Q1-E1-D3	LIB22	g527628	BLASTN	1885	1e-148	97
11	6090	LIB22-062-Q1-E1-G5	LIB22	g527628	BLASTN	2025	1e-160	100
12	6090	LIB22-025-Q1-E1-F10	LIB22	g527628	BLASTN	1836	1e-144	99
13	6663	LIB24-122-Q1-E1-E1	LIB24	g166607	BLASTN	1936	1e-155	99
14	6663	LIB24-123-Q1-E1-B8	LIB24	g166607	BLASTN	2116	1e-170	99
15	6663	LIB25-104-Q1-E1-B12	LIB25	g166607	BLASTN	1791	1e-141	99
16	6663	LIB25-088-Q1-E1-C12	LIB25	g166607	BLASTN	1971	1e-158	99
17	6965	LIB24-029-Q1-E1-B8	LIB24	g499163	BLASTN	1620	1e-126	100
18	6965	LIB25-067-Q1-E1-A5	LIB25	g499163	BLASTN	1828	1e-144	99
19	6965	LIB25-087-Q1-E1-A9	LIB25	g499163	BLASTN	945	1e-70	100
20	6965	LIB35-010-Q1-E1-H6	LIB35	g499163	BLASTN	1855	1e-146	100
21	7845	LIB24-015-Q1-E1-G5	LIB24	g16161	BLASTN	1965	1e-157	98
22	8076	ARABL1-023-Q1-B1-H6	LIB9	g166751	BLASTN	1514	1e-117	91
23	8318	LIB23-061-	LIB23	g499159	BLASTN	1720	1e-134	100

24	8318	Q1-E1-D11 LIB24-058-	LIB24	g499159	BLASTN	1776	1e-139	99
25	8318	Q1-E1-F6 LIB24-070-	LIB24	g499159	BLASTN	1851	1e-145	98
26	8318	Q1-E1-E7 LIB25-101-	LIB25	g499159	BLASTN	1696	1e-132	99
27	8352	Q1-E1-H2 LIB22-060-	LIB22	g499162	BLASTN	63	1e-17	57
28	8352	Q1-E1-C4 LIB23-010-	LIB23	g499162	BLASTN	64	1e-19	52
29	8782	Q1-E1-H5 ARABL1-029-	LIB9	g499161	BLASTN	1542	1e-119	97
30	8782	Q1-B1-H4 ARABL1-025-	LIB9	g499161	BLASTN	1532	1e-119	94
31	8782	Q1-B1-B5 LIB23-023-	LIB23	g499161	BLASTN	1740	1e-147	98
32	8782	Q1-E1-B6 LIB23-057-	LIB23	g499161	BLASTN	1673	1e-130	99
33	8782	Q1-E1-D3 LIB23-074-	LIB23	g499161	BLASTN	1781	1e-139	99
34	8782	Q1-E1-E7 LIB24-133-	LIB24	g499161	BLASTN	1594	1e-124	98
35	8782	Q1-E1-B2 LIB25-019-	LIB25	g499161	BLASTN	1916	1e-151	99
36	8782	Q1-E1-G7 LIB25-110-	LIB25	g499161	BLASTN	1584	1e-123	96
37	8810	Q1-E1-B12 LIB22-038-	LIB22	g16327	BLASTN	1865	1e-146	100
38	8810	Q1-E1-F9 LIB25-045-	LIB25	g16327	BLASTN	1951	1e-158	97
39	8810	Q1-E1-F7 LIB35-012-	LIB35	g16327	BLASTN	1863	1e-146	98
40	8810	Q1-E1-F11 LIB35-006-	LIB35	g16327	BLASTN	948	1e-140	99
41	9334	Q1-E1-C12 ARABL1-032-	LIB9	g527636	BLASTN	367	1e-19	97
42	9433	Q1-E1-C4 LIB23-030-	LIB23	g499161	BLASTN	1099	1e-82	94
43	9433	Q1-E1-C10 LIB35-024-	LIB35	g499161	BLASTN	2130	1e-169	100
44	9433	Q1-E1-H6 LIB35-031-	LIB35	g499161	BLASTN	1836	1e-144	98
45	9433	Q1-E1-D9 LIB35-002-	LIB35	g499161	BLASTN	1229	1e-119	89
46	9454	Q1-E1-D7 LIB35-023-	LIB35	g3153206	BLASTN	1582	1e-153	97
47	9454	Q1-E1-F1 LIB35-011-	LIB35	g3153206	BLASTN	1665	1e-130	90
48	9542	Q1-E1-H5 LIB23-045-	LIB23	g1045041	BLASTN	730	1e-57	99
49	9542	Q1-E1-B9 LIB35-047-	LIB35	g1045041	BLASTN	1593	1e-123	92
		Q1-E1-D3						

ARABIDOPSIS THALIANA HLH TRANSCRIPTION FACTORS

Seq No.	Cluster ID	CloneID	Library	NCBI gi	METHOD	Score	P-Value	%Ident
50	1965	LIB23-023-Q1-E1-E6	LIB23	g1465367	BLASTN	1320	1e-168	98
51	219	LIB24-004-Q1-E1-F9	LIB24	g3193326	BLASTN	134	1e-20	69
52	2673	LIB22-019-Q1-E1-D8	LIB22	g1465367	BLASTN	1970	1e-157	97
53	2673	LIB25-058-P1-E1-A2	LIB25	g1465367	BLASTN	2026	1e-159	99
54	3920	LIB24-021-Q1-E1-H4	LIB24	g1154626	BLASTN	2032	1e-160	99
55	5164	LIB25-040-Q1-E1-D6	LIB25	g1154626	BLASTN	2032	1e-160	98
56	6525	LIB24-060-Q1-E1-H4	LIB24	g1465367	BLASTN	1864	1e-146	99
57	6694	LIB22-036-Q1-E1-C10	LIB22	g1465367	BLASTN	792	1e-57	95
58	7297	LIB23-043-Q1-E1-H6	LIB23	g1465367	BLASTN	1766	1e-138	98
59	7297	LIB25-086-Q1-E1-D5	LIB25	g1465367	BLASTN	1032	1e-77	99
60	7297	LIB25-097-Q1-E1-H11	LIB25	g1465367	BLASTN	1001	1e-74	99
61	8183	ARABL1-024-Q1-B1-C9	LIB9	g3036810	BLASTN	213	1e-31	51
62	8183	LIB22-082-Q1-E2-A1	LIB22	g3036810	BLASTN	247	1e-36	55
63	8183	LIB24-034-Q1-E1-A7	LIB24	g3036810	BLASTN	257	1e-37	55
64	8539	LIB35-055-Q1-E1-B3	LIB35	g1154626	BLASTN	1533	1e-118	99
65	8539	LIB35-055-Q1-E2-B3	LIB35	g1154626	BLASTN	2085	1e-164	100

ARABIDOPSIS THALIANA LEUCINE ZIPPER TRANSCRIPTION FACTORS

Seq No.	Cluster ID	CloneID	Library	NCBI gi	METHOD	Score	P-Value	%Ident
66	2474	LIB25-040-Q1-E1-E1	LIB25	g1806260	BLASTN	463	1e-27	70
67	4341	LIB25-074-Q1-E1-H2	LIB25	g1865678	BLASTN	295	1e-13	73
68	4559	LIB22-065-Q1-E1-C5	LIB22	g19274	BLASTN	340	1e-38	65
69	4559	LIB25-040-Q1-E1-F10	LIB25	g19274	BLASTN	277	1e-11	67
70	5743	LIB22-058-Q1-E1-C10	LIB22	g3297824	BLASTN	121	1e-25	64
71	5743	LIB24-131-Q1-E1-G1	LIB24	g3297824	BLASTN	121	1e-25	64

72	6498	LIB24-089-Q1-E1-D7	LIB24	g1806261	BLASTN	121	1e-28	50
73	6498	LIB25-013-Q1-E1-H7	LIB25	g1806261	BLASTN	81	1e-19	66
74	8748	LIB23-023-Q1-E1-A9	LIB23	g1865678	BLASTN	328	1e-16	75
75	8748	LIB24-045-Q1-E1-E7	LIB24	g1865678	BLASTN	328	1e-16	75
76	8748	LIB35-027-Q1-E1-H9	LIB35	g1769890	BLASTN	452	1e-26	70
77	897	LIB25-025-Q1-E1-A12	LIB25	g19275	BLASTN	114	1e-35	48
78	9263	ARABLI-14-Q1-B1-A5	LIB9	g1033194	BLASTN	1728	1e-135	97
79	9263	ARABLI-024-Q1-B1-A8	LIB9	g1033194	BLASTN	2015	1e-159	99
80	9263	LIB23-037-Q1-E1-H10	LIB23	g1033194	BLASTN	1331	1e-102	99
81	9263	LIB23-014-Q1-E1-A6	LIB23	g1033194	BLASTN	1747	1e-137	98
82	9263	LIB23-035-Q1-E112-F8	LIB23	g1033194	BLASTN	1882	1e-148	99
83	9263	LIB24-137-Q1-E1-G11	LIB24	g1033194	BLASTN	1752	1e-137	99
84	9263	LIB25-024-Q1-E1-B1	LIB25	g1033194	BLASTN	1531	1e-118	99
85	9263	LIB25-112-Q1-E1-E7	LIB25	g1033194	BLASTN	963	1e-71	96
86	9263	LIB25-039-Q1-E1-D6	LIB25	g1033194	BLASTN	2211	1e-176	99
87	9263	LIB25-091-Q1-E1-G10	LIB25	g1033194	BLASTN	1911	1e-150	99
88	9263	LIB25-031-Q1-E1-D12	LIB25	g1033194	BLASTN	2016	1e-159	99
89	9263	LIB25-098-Q1-E1-F9	LIB25	g1033194	BLASTN	1891	1e-149	99
46	9454	LIB35-023-Q1-E1-F1	LIB35	g3153206	BLASTN	1582	1e-153	97
47	9454	LIB35-011-Q1-E1-H5	LIB35	g3153206	BLASTN	1665	1e-130	90
90	9532	LIB35-023-Q1-E1-F11	LIB35	g403417	BLASTN	1458	1e-113	98
91	9532	LIB35-021-Q1-E1-D9	LIB35	g403417	BLASTN	1766	1e-141	99
92	959	LIB25-039-Q1-E1-D12	LIB25	g1865678	BLASTN	2196	1e-176	96
93	994	LIB146-009-Q1-E1-A1	LIB146	g3297824	BLASTN	99	1e-26	68

ARABIDOPSIS THALIANA ZINC FINGER TRANSCRIPTION FACTORS

Seq No.	Cluster ID	CloneID	Library	NCBI gi	METHOD	Score	P-Value	%Ident
94	1456	LIB35-026-Q1-E1-H4	LIB35	g1359492	BLASTN	705	1e-49	100

95	2391	LIB25-086-Q1-E1-F5	LIB25	g1418334	BLASTN	917	1e-67	98
96	2609	LIB146-013-Q1-E1-D8	LIB146	g2961541	BLASTN	1975	1e-158	100
97	2609	LIB146-008-Q1-E1-B9	LIB146	g2961541	BLASTN	1279	1e-98	90
98	2752	LIB22-068-Q1-E1-C6	LIB22	g1359492	BLASTN	327	1e-16	70
99	2929	LIB24-026-Q1-E1-H7	LIB24	g340456	BLASTN	87	1e-22	43
100	4393	LIB24-095-Q1-E1-C8	LIB24	g2582642	BLASTN	1850	1e-148	100
101	4451	LIB25-016-Q1-E1-E12	LIB25	g1800278	BLASTN	2020	1e-159	98
102	4451	LIB25-007-Q1-E1-F1	LIB25	g1800278	BLASTN	1601	1e-124	95
103	4510	ARABL1-025-Q1-B1-G9	LIB9	g790686	BLASTN	482	1e-31	98
104	5651	LIB23-060-Q1-E1-A4	LIB23	g1773039	BLASTN	269	1e-11	72
105	5651	LIB23-045-Q1-E1-C6	LIB23	g1773039	BLASTN	266	1e-11	74
106	5651	LIB24-014-Q1-E1-G10	LIB24	g1773039	BLASTN	260	1e-10	71
107	6087	LIB146-012-Q1-E1-G4	LIB146	g2511546	BLASTN	86	1e-18	53
108	6653	LIB22-014-Q1-E1-D6	LIB22	g1360087	BLASTN	501	1e-31	77
109	6653	LIB23-039-Q1-E1-D4	LIB23	g1360088	BLASTN	166	1e-26	90
110	6653	LIB25-112-Q1-E1-C8	LIB25	g1359492	BLASTN	496	1e-30	78
111	7386	LIB22-011-Q1-K1-E4	LIB22	g1871192	BLASTN	212	1e-33	47
112	7386	LIB22-085-Q1-E2-B1	LIB22	g1871192	BLASTN	119	1e-21	53
113	7386	LIB22-058-Q1-E1-B11	LIB22	g1871192	BLASTN	132	1e-23	51
114	7386	LIB22-001-Q1-E1-B5	LIB22	g1871192	BLASTN	135	1e-23	51
115	7551	LIB25-068-Q1-E1-B4	LIB25	g1872520	BLASTN	1056	1e-135	99
116	7827	LIB23-057-Q1-E1-E6	LIB23	g2340087	BLASTN	1559	1e-121	98
117	8238	LIB22-004-Q1-E1-G7	LIB22	g1360087	BLASTN	422	1e-24	72
118	8238	LIB25-078-Q1-E1-G1	LIB25	g1360086	BLASTN	130	1e-20	79
119	8287	ARABL1-019-Q1-B1-G1	LIB9	g1800278	BLASTN	343	1e-22	74
120	8287	ARABL1-025-Q1-B1-C6	LIB9	g1800278	BLASTN	343	1e-22	76
121	8287	LIB22-067-Q1-E1-H9	LIB22	g1800278	BLASTN	336	1e-16	75

122	8287	LIB25-007-Q1-E1-G11	LIB25	g1800278	BLASTN	336	1e-23	77
123	8287	LIB35-002-Q1-E1-H6	LIB35	g1800278	BLASTN	699	1e-58	78
124	8469	LIB25-006-Q1-E2-A7	LIB25	g1182006	BLASTN	736	1e-53	78
125	8479	LIB24-136-Q1-E1-G9	LIB24	g2582644	BLASTN	2042	1e-163	99
126	8479	LIB25-066-Q1-E1-C10	LIB25	g2582644	BLASTN	1958	1e-156	99
127	8479	LIB35-042-Q1-E1-H4	LIB35	g2582644	BLASTN	1729	1e-137	98
128	849	LIB35-005-Q1-E1-A1	LIB35	g2780365	BLASTN	165	1e-35	51
129	849	LIB35-043-Q1-E1-A2	LIB35	g2780365	BLASTN	165	1e-35	51
130	8725	LIB22-051-Q1-E1-D4	LIB22	g2961541	BLASTN	404	1e-22	60
131	8725	LIB22-078-Q1-E1-H1	LIB22	g1800278	BLASTN	452	1e-33	66
132	8725	LIB22-075-Q1-E1-D4	LIB22	g1871192	BLASTN	223	1e-32	41
133	8725	LIB22-034-Q1-E2-G1	LIB22	g1871192	BLASTN	264	1e-38	55
134	8725	LIB23-051-Q1-E1-E12	LIB23	g1871192	BLASTN	151	1e-27	49
135	8744	ARABL1-031-Q1-B1-G12	LIB9	g1565226	BLASTN	645	1e-45	96
136	8744	LIB22-078-Q1-E1-F9	LIB22	g1418322	BLASTN	2102	1e-167	99
137	8744	LIB22-068-Q1-E1-A4	LIB22	g1418322	BLASTN	2000	1e-158	98
138	8744	LIB22-056-Q1-E1-E11	LIB22	g1565226	BLASTN	1818	1e-145	99
139	8744	LIB25-104-Q1-E1-D7	LIB25	g1565226	BLASTN	1710	1e-135	100
140	8744	LIB35-015-Q1-E1-H12	LIB35	g1418322	BLASTN	743	1e-55	97
141	8794	LIB24-135-Q1-E1-A6	LIB24	g2801793	BLASTN	113	1e-18	50
142	9044	LIB22-023-Q1-E1-G11	LIB22	g1800278	BLASTN	1721	1e-159	98
143	9044	LIB23-043-Q1-E1-F1	LIB23	g1800278	BLASTN	1721	1e-158	98
144	9044	LIB23-035-Q1-E112-G6	LIB23	g1800278	BLASTN	1721	1e-147	98
145	9044	LIB24-059-Q1-E1-D4	LIB24	g1800278	BLASTN	1649	1e-131	97
146	9044	LIB24-124-Q1-E1-A2	LIB24	g1800278	BLASTN	1649	1e-150	96
147	9044	LIB24-126-Q1-E1-G8	LIB24	g1800278	BLASTN	1712	1e-149	98
148	9044	LIB24-124-Q1-E2-A2	LIB24	g1800278	BLASTN	1667	1e-132	96

ARABIDOPSIS THALIANA OTHER TRANSCRIPTION FACTORS

Seq No.	Cluster ID	CloneID	Library	NCBI gi	METHOD	Score	P-Value	%Ident
149	1486	LIB22-056-Q1-E1-H3	LIB22	g2564336	BLASTN	1769	1e-138	92
150	162	LIB24-090-Q1-E1-F7	LIB24	g2961084	BLASTN	2170	1e-171	100
151	1625	LIB23-065-Q1-E1-G1	LIB23	g2555018	BLASTN	83	1e-17	38
152	1979	LIB24-112-Q1-E1-F3	LIB24	g2398524	BLASTN	406	1e-22	69
153	1996	LIB25-073-Q1-E1-E3	LIB25	g19259	BLASTN	574	1e-36	77
154	2289	LIB146-012-Q1-E1-C11	LIB146	g3399764	BLASTN	600	1e-39	72
155	236	LIB23-013-Q1-E1-F1	LIB23	g2765441	BLASTN	1336	1e-145	95
156	236	LIB25-077-Q1-E1-E11	LIB25	g2765441	BLASTN	1761	1e-157	95
157	2370	LIB146-026-Q1-K1-G11	LIB146	g16545	BLASTN	1055	1e-125	93
158	2476	LIB22-087-Q1-E1-E2	LIB22	g2196466	BLASTN	217	1e-56	61
159	2476	LIB25-002-Q1-E1-A8	LIB25	g2196466	BLASTN	218	1e-55	62
160	2700	LIB22-087-Q1-E1-D10	LIB22	g2832403	BLASTN	1734	1e-136	98
161	2700	LIB23-069-Q1-E1-F11	LIB23	g2832403	BLASTN	1481	1e-114	99
162	2758	LIB22-047-Q1-E1-C3	LIB22	g1747309	BLASTN	1712	1e-136	99
163	2758	LIB22-031-Q1-E1-C7	LIB22	g1747309	BLASTN	1392	1e-107	99
164	2772	LIB22-033-Q1-E2-G2	LIB22	g1183866	BLASTN	174	1e-28	62
165	2772	LIB22-033-Q1-E1-G2	LIB22	g1183864	BLASTN	112	1e-17	45
166	2824	LIB22-031-Q1-E1-H8	LIB22	g2832407	BLASTN	923	1e-68	75
167	2881	LIB24-118-Q1-E1-B3	LIB24	g2959733	BLASTN	1732	1e-138	99
168	2929	LIB22-059-Q1-E1-C11	LIB22	g64475	BLASTN	67	1e-18	46
169	3322	LIB22-056-Q1-E1-G12	LIB22	g2398522	BLASTN	1538	1e-119	99
170	3322	LIB22-014-Q1-E1-E7	LIB22	g2398522	BLASTN	1724	1e-135	98
171	3596	LIB24-070-Q1-E1-E8	LIB24	g2959735	BLASTN	2033	1e-163	99
172	3605	LIB22-055-Q1-E1-D6	LIB22	g786425	BLASTN	271	1e-17	71

173	3808	ARABL1-01-Q1-E1-E12	LIB9	g1263094	BLASTN	1917	1e-151	99
174	4015	LIB22-020-Q1-E1-E8	LIB22	g20562	BLASTN	664	1e-45	71
175	4127	LIB22-031-Q1-E1-A4	LIB22	g2826883	BLASTN	1880	1e-148	90
176	4333	LIB22-032-Q1-E1-B8	LIB22	g2145357	BLASTN	2073	1e-163	99
177	4333	LIB22-041-Q1-E1-F7	LIB22	g2145357	BLASTN	2098	1e-165	99
178	4333	LIB22-086-Q1-E1-F5	LIB22	g2145357	BLASTN	1930	1e-157	98
179	4522	LIB23-040-Q1-E1-E7	LIB23	g3329392	BLASTN	151	1e-21	41
180	4522	LIB25-083-Q1-E1-D11	LIB25	g3329392	BLASTN	170	1e-25	41
181	4681	LIB22-013-Q1-E1-A1	LIB22	g2398524	BLASTN	1630	1e-127	100
182	4681	LIB22-015-Q1-E1-A11	LIB22	g2398524	BLASTN	2047	1e-162	99
183	4681	LIB24-123-Q1-E1-A1	LIB24	g2398524	BLASTN	2135	1e-169	98
184	5098	LIB22-088-Q1-E1-F11	LIB22	g2959731	BLASTN	1885	1e-149	100
185	5133	LIB23-048-Q1-E1-H10	LIB23	g1666172	BLASTN	908	1e-67	79
186	5133	LIB25-114-Q1-E1-A6	LIB25	g1666172	BLASTN	785	1e-56	75
187	5347	LIB22-044-Q1-E1-E12	LIB22	g2245393	BLASTN	2053	1e-162	99
188	5347	LIB23-017-Q1-E1-E6	LIB23	g2245393	BLASTN	1538	1e-119	92
189	5347	LIB24-093-Q1-E1-A12	LIB24	g2245393	BLASTN	2016	1e-159	98
190	537	LIB35-005-Q1-E1-F1	LIB35	g2398532	BLASTN	427	1e-24	72
191	537	LIB35-045-Q1-E1-B6	LIB35	g2398532	BLASTN	334	1e-16	73
192	5417	LIB23-035-Q1-E1-H11	LIB23	g3399764	BLASTN	326	1e-15	82
193	5417	LIB24-132-Q1-E1-A7	LIB24	g3399764	BLASTN	400	1e-22	80
194	5515	LIB25-046-Q1-E1-D6	LIB25	g2252479	BLASTN	333	1e-16	94
195	5599	LIB23-022-Q2-E1-E4	LIB23	g1514441	BLASTN	283	1e-12	65
196	5599	LIB23-039-Q1-E1-F7	LIB23	g1514441	BLASTN	519	1e-32	67
197	5721	LIB22-075-Q1-E1-G6	LIB22	g304112	BLASTN	329	1e-16	73
198	5913	LIB25-037-Q1-E1-C5	LIB25	g1429225	BLASTN	1733	1e-135	99
199	6004	LIB22-063-Q1-E1-H9	LIB22	g3183616	BLASTN	672	1e-45	74

200	6004	LIB24-115-Q1-E1-B2	LIB24	g3183616	BLASTN	674	1e-46	75
201	6004	LIB24-087-Q1-E1-A8	LIB24	g3183616	BLASTN	946	1e-70	75
202	6171	ARABLI-14-Q1-B1-A11	LIB9	g2832405	BLASTN	780	1e-56	78
203	6171	LIB22-038-Q1-E1-A1	LIB22	g2832405	BLASTN	920	1e-67	78
204	6171	LIB24-136-Q1-E1-B11	LIB24	g2832405	BLASTN	317	1e-15	81
205	6171	LIB35-043-Q1-E1-H9	LIB35	g2832405	BLASTN	777	1e-55	77
206	6246	LIB22-055-Q1-E1-F7	LIB22	g2245393	BLASTN	1969	1e-155	97
207	6246	LIB24-010-Q1-E1-C8	LIB24	g2245393	BLASTN	1887	1e-161	98
208	6276	ARABLI-12-Q1-B1-C2	LIB9	g1850792	BLASTN	793	1e-127	98
209	6397	ARABLI-031-Q1-B1-E8	LIB9	g2398530	BLASTN	841	1e-99	83
210	6602	LIB146-026-Q1-K1-B5	LIB146	g16428	BLASTN	1154	1e-159	97
211	6602	LIB24-012-Q1-E1-G11	LIB24	g16428	BLASTN	2106	1e-166	99
212	6653	LIB24-001-Q1-E1-D10	LIB24	g2920707	BLASTN	513	1e-33	78
213	6801	LIB22-056-Q1-E1-G9	LIB22	g945084	BLASTN	1000	1e-74	100
214	6801	LIB24-062-Q1-E1-F9	LIB24	g945084	BLASTN	1196	1e-91	99
215	6801	LIB25-056-Q1-E1-B4	LIB25	g945084	BLASTN	1186	1e-90	99
216	6801	LIB25-105-Q1-E1-C1	LIB25	g945084	BLASTN	1155	1e-87	100
217	7125	LIB22-035-Q1-E1-D8	LIB22	g786425	BLASTN	365	1e-19	72
218	7125	LIB24-060-Q1-E1-F5	LIB24	g786425	BLASTN	419	1e-44	77
219	7252	LIB35-042-Q1-E1-B7	LIB35	g1747309	BLASTN	1151	1e-87	99
220	7274	ARABLI-033-Q1-B1-A7	LIB9	g2826881	BLASTN	841	1e-77	96
221	7320	LIB24-123-Q1-E2-A5	LIB24	g166587	BLASTN	1651	1e-130	99
222	7320	LIB24-123-Q1-E1-A5	LIB24	g166587	BLASTN	1565	1e-122	100
223	7320	LIB25-001-Q1-E2-G12	LIB25	g166595	BLASTN	2102	1e-169	99
224	7320	LIB25-001-Q1-E1-G12	LIB25	g166595	BLASTN	2013	1e-161	99
225	7320	LIB25-013-Q1-E1-F5	LIB25	g166587	BLASTN	1941	1e-155	98
226	7321	LIB22-026-Q1-E1-B8	LIB22	g1890351	BLASTN	795	1e-57	84

227	7321	LIB24-028-Q1-E1-A3	LIB24	g1890351	BLASTN	823	1e-94	82
228	7321	LIB25-051-Q1-E1-D10	LIB25	g1890351	BLASTN	824	1e-106	83
229	7425	LIB22-076-Q1-E1-B3	LIB22	g2832517	BLASTN	639	1e-44	97
230	7486	LIB24-016-Q1-E1-A5	LIB24	g166592	BLASTN	2061	1e-163	99
231	7486	LIB24-047-Q1-E1-A12	LIB24	g166589	BLASTN	1749	1e-137	98
232	7486	LIB24-025-Q1-E1-C8	LIB24	g166592	BLASTN	2013	1e-159	97
233	7486	LIB25-016-Q1-E1-F11	LIB25	g166589	BLASTN	2020	1e-159	100
234	7486	LIB25-111-Q1-E1-C9	LIB25	g166589	BLASTN	1965	1e-155	100
235	7500	LIB146-010-Q1-E1-F7	LIB146	g2959729	BLASTN	1365	1e-105	100
236	7500	LIB22-043-Q1-E1-B12	LIB22	g2959729	BLASTN	2046	1e-162	99
237	7584	LIB24-118-Q1-E1-C12	LIB24	g2462080	BLASTN	1354	1e-106	88
238	7584	LIB24-058-Q1-E1-H3	LIB24	g2462080	BLASTN	1775	1e-141	100
239	7584	LIB24-069-Q1-E1-F1	LIB24	g2462080	BLASTN	1980	1e-158	100
240	7584	LIB24-132-Q1-E1-F9	LIB24	g2462080	BLASTN	2050	1e-164	100
241	7590	LIB24-109-Q1-E1-H7	LIB24	g1666172	BLASTN	919	1e-68	74
242	7590	LIB35-030-Q1-E1-C8	LIB35	g1666172	BLASTN	865	1e-63	73
243	7630	LIB22-008-Q1-E1-F8	LIB22	g2398532	BLASTN	811	1e-59	79
244	7630	LIB25-051-Q1-E1-D11	LIB25	g2398532	BLASTN	678	1e-46	77
245	7630	LIB25-076-Q1-E1-D11	LIB25	g2398532	BLASTN	415	1e-23	80
246	7650	LIB25-032-Q1-E1-E9	LIB25	g16547	BLASTN	1906	1e-150	91
247	7650	LIB25-094-Q1-E1-H12	LIB25	g16545	BLASTN	985	1e-73	100
248	7819	LIB22-080-Q1-E1-B2	LIB22	g3395937	BLASTN	1542	1e-119	99
249	7819	LIB22-056-Q1-E1-F8	LIB22	g3395937	BLASTN	1735	1e-135	98
250	7819	LIB22-080-Q1-E2-B2	LIB22	g3395937	BLASTN	1477	1e-114	99
251	7857	LIB22-081-Q1-E2-A5	LIB22	g2564336	BLASTN	1465	1e-118	89
252	7857	LIB22-017-Q1-E1-A6	LIB22	g2564336	BLASTN	1506	1e-121	89
253	7857	LIB24-010-Q1-E1-H9	LIB24	g2564336	BLASTN	1233	1e-99	86

254	7857	LIB25-111-Q1-E1-B3	LIB25	g2564336	BLASTN	1548	1e-125	88
255	7857	LIB25-066-Q1-E1-C8	LIB25	g2564336	BLASTN	1475	1e-119	89
256	7857	LIB25-115-Q1-E1-B9	LIB25	g2564336	BLASTN	1465	1e-117	89
257	7984	LIB35-011-Q1-E1-A10	LIB35	g928968	BLASTN	368	1e-40	86
258	8232	LIB22-028-Q1-E1-B4	LIB22	g2104680	BLASTN	341	1e-17	69
259	8629	LIB22-035-Q1-E1-H7	LIB22	g2104680	BLASTN	248	1e-09	63
260	8629	LIB23-013-Q1-E1-E9	LIB23	g2104680	BLASTN	262	1e-10	67
261	8629	LIB24-048-Q1-E2-E6	LIB24	g2104680	BLASTN	253	1e-09	66
262	8629	LIB24-048-Q1-E1-E6	LIB24	g2104680	BLASTN	244	1e-09	65
263	8728	ARABL1-02-Q1-E1-G10	LIB9	g1173615	BLASTN	200	1e-09	84
264	8736	LIB22-004-Q1-E1-C9	LIB22	g556558	BLASTN	415	1e-61	68
265	8736	LIB22-064-Q1-E1-H5	LIB22	g556557	BLASTN	1097	1e-82	75
266	8736	LIB22-022-Q1-E1-A3	LIB22	g556558	BLASTN	243	1e-37	70
267	8736	LIB23-066-Q1-E1-D2	LIB23	g556558	BLASTN	327	1e-50	79
268	8736	LIB23-001-Q1-E1-F11	LIB23	g556558	BLASTN	334	1e-50	78
269	8736	LIB24-092-Q1-E1-B7	LIB24	g556557	BLASTN	694	1e-47	65
270	8773	LIB22-035-Q1-E1-D10	LIB22	g1572786	BLASTN	86	1e-19	45
271	8873	ARABL1-022-Q1-B1-H10	LIB9	g1263094	BLASTN	2026	1e-160	99
272	8873	ARABL1-022-Q1-B1-D1	LIB9	g1263094	BLASTN	1978	1e-156	99
273	8873	ARABL1-019-Q1-B1-G3	LIB9	g1263094	BLASTN	1816	1e-142	99
274	8873	LIB22-088-Q1-E1-E11	LIB22	g1263094	BLASTN	1856	1e-146	99
275	8873	LIB23-036-Q1-E1-C12	LIB23	g1263094	BLASTN	1892	1e-149	99
276	8873	LIB24-090-Q1-E1-D12	LIB24	g1263094	BLASTN	2041	1e-162	99
277	8873	LIB25-003-Q1-E1-H3	LIB25	g1263094	BLASTN	1867	1e-147	99
278	8873	LIB25-114-Q1-E1-B5	LIB25	g1263094	BLASTN	1931	1e-152	99
279	8873	LIB25-084-Q1-E1-E6	LIB25	g1263094	BLASTN	1080	1e-81	100
280	8919	LIB22-079-Q1-E1-G7	LIB22	g2505876	BLASTN	302	1e-45	89

281	8919	LIB24-031-Q1-E1-F8	LIB24	g2505876	BLASTN	291	1e-48	81
282	8993	LIB146-015-Q1-E1-H7	LIB146	g1292897	BLASTN	406	1e-22	63
283	8994	ARABLI-029-Q1-B1-C2	LIB9	g1890351	BLASTN	1316	1e-101	99
284	8994	ARABLI-15-Q1-B1-H9	LIB9	g1890351	BLASTN	1318	1e-108	97
285	8994	LIB22-047-Q1-E1-D5	LIB22	g1890351	BLASTN	1555	1e-125	100
286	8994	LIB22-031-Q1-E1-F10	LIB22	g1890351	BLASTN	1245	1e-95	98
287	8994	LIB24-077-Q1-E1-G6	LIB24	g1890351	BLASTN	1476	1e-114	93
288	8994	LIB25-085-Q1-E1-B10	LIB25	g1890351	BLASTN	1461	1e-113	99
289	9030	LIB23-072-Q1-E1-G1	LIB23	g290056	BLASTN	454	1e-26	68
290	9030	LIB23-021-Q2-E1-C3	LIB23	g290056	BLASTN	472	1e-28	70
291	9106	LIB24-122-Q1-E1-A6	LIB24	g2104680	BLASTN	232	1e-09	75
292	9106	LIB24-136-Q1-E1-G12	LIB24	g2104680	BLASTN	420	1e-23	72
293	9106	LIB25-044-Q1-E1-G7	LIB25	g2104680	BLASTN	232	1e-08	75
294	9532	LIB24-073-Q1-E1-C2	LIB24	g3184053	BLASTN	361	1e-23	64
295	9532	LIB25-027-Q1-E1-D7	LIB25	g1483229	BLASTN	422	1e-24	66
296	9532	LIB35-004-Q1-E1-H9	LIB35	g1483229	BLASTN	413	1e-23	65
297	9532	LIB35-043-Q1-E1-F9	LIB35	g939780	BLASTN	394	1e-21	68
298	9532	LIB35-052-Q1-E1-D8	LIB35	g1483229	BLASTN	413	1e-23	65
299	9542	LIB23-068-Q1-E1-H9	LIB23	g2735764	BLASTN	255	1e-52	58

MAIZE ZINC-FINGER TRANSCRIPTION FACTORS

Seq No.	Cluster ID	CloneID	Library	NCBI gi	METHOD	Score	P-Value	%Ident
300	-700016325	700016325H1	SATMON001	g2746333	BLASTN	162	1e-24	50
301	-700026959	700026959H1	SATMON003	g2088668	BLASTN	181	1e-26	54
302	-700027280	700027280H1	SATMON003	g441220	BLASTN	233	1e-26	79
303	-700027480	700027480H1	SATMON003	g2746333	BLASTN	129	1e-21	66
304	-700042789	700042789H1	SATMON004	g1872521	BLASTN	170	1e-36	64
305	-700048422	700048422H1	SATMON003	g1871192	BLASTN	73	1e-18	69
306	-700051791	700051791H1	SATMON003	g441220	BLASTN	238	1e-20	79
307	-700075825	700075825H1	SATMON007	g790683	BLASTN	163	1e-24	90
308	-700076194	700076194H1	SATMON007	g1321818	BLASTN	172	1e-25	50
309	-700083928	700083928H1	SATMON011	g1517914	BLASTN	111	1e-18	46
310	-700085230	700085230H1	SATMON011	g2708744	BLASTN	288	1e-41	60

311	-700091647	700091647H1	SATMON011	g885730	BLASTN	66	1e-19	64
312	-700100924	700100924H1	SATMON009	g2582645	BLASTN	136	1e-20	83
313	-700105860	700105860H1	SATMON010	g1872521	BLASTN	115	1e-20	42
314	-700156073	700156073H1	SATMON007	g1435057	BLASTN	129	1e-27	47
315	-700162355	700162355H1	SATMON012	g2435518	BLASTN	211	1e-31	48
316	-700164124	700164124H1	SATMON013	g1519680	BLASTN	130	1e-19	45
317	-700164638	700164638H1	SATMON013	g3033395	BLASTN	94	1e-17	48
318	-700167644	700167644H1	SATMON013	g2582643	BLASTN	94	1e-17	91
319	-700168811	700168811H1	SATMON013	g2104419	BLASTN	114	1e-19	50
320	-700172615	700172615H1	SATMON013	g1304599	BLASTN	136	1e-26	45
321	-700196512	700196512H1	SATMON014	g532810	BLASTN	116	1e-27	50
322	-700201723	700201723H1	SATMON003	g1843401	BLASTN	122	1e-18	41
323	-700203560	700203560H1	SATMON003	g2058504	BLASTN	123	1e-19	67
324	-700214674	700214674H1	SATMON016	g18819	BLASTN	159	1e-24	70
325	-700219515	700219515H1	SATMON011	g1182006	BLASTN	524	1e-33	89
326	-700219825	700219825H1	SATMON011	g166306	BLASTN	182	1e-35	61
327	-700220954	700220954H1	SATMON011	g1871192	BLASTN	77	1e-21	49
328	-700235252	700235252H1	SATMON010	g1136384	BLASTN	99	1e-17	37
329	-700237256	700237256H1	SATMON010	g1565227	BLASTN	116	1e-27	66
330	-700240108	700240108H1	SATMON010	g2160396	BLASTN	161	1e-24	44
331	-700242130	700242130H1	SATMON010	g1183987	BLASTN	101	1e-22	57
332	-700257451	700257451H2	SATMON017	g1871192	BLASTN	205	1e-36	59
333	-700321754	700321754H1	SATMON025	g1304599	BLASTN	144	1e-21	43
334	-700341394	700341394H1	SATMON020	g2911058	BLASTN	150	1e-22	67
335	-700341946	700341946H1	SATMON020	g2104677	BLASTN	97	1e-28	60
336	-700345248	700345248H1	SATMON021	g2746333	BLASTN	140	1e-21	47
337	-700352228	700352228H1	SATMON023	g2827537	BLASTN	343	1e-49	76
338	-700353885	700353885H1	SATMON024	g1438877	BLASTN	162	1e-28	53
339	-700381224	700381224H1	SATMON023	g469800	BLASTN	145	1e-21	64
340	-700405481	700405481H1	SATMON029	g2708744	BLASTN	317	1e-45	60
341	-700423875	700423875H1	SATMONN01	g2911058	BLASTN	164	1e-24	67
342	-700431146	700431146H1	SATMONN01	g2435518	BLASTN	232	1e-34	44
343	-700438785	700438785H1	SATMON026	g1872523	BLASTN	128	1e-19	61
344	-700445561	700445561H1	SATMON027	g485815	BLASTN	278	1e-12	83
345	-700452922	700452922H1	SATMON028	g1182006	BLASTN	451	1e-39	80
346	-700453237	700453237H1	SATMON028	g2598954	BLASTN	79	1e-17	53
347	-700456055	700456055H1	SATMON029	g2827537	BLASTN	168	1e-29	80
348	-700477970	700477970H1	SATMON025	g2582645	BLASTN	78	1e-18	46
349	-700575550	700575550H1	SATMON030	g2464919	BLASTN	214	1e-31	69
350	-700582866	700582866H1	SATMON031	g2522524	BLASTN	127	1e-21	58
351	-700611202	700611202H1	SATMON022	g2827537	BLASTN	148	1e-31	64
352	-700614785	700614785H1	SATMON033	g1946361	BLASTN	184	1e-27	44
353	-700621114	700621114H1	SATMON034	g2738419	BLASTN	80	1e-17	48
354	-700807291	700807291H1	SATMON036	g2911058	BLASTN	121	1e-18	37
355	-701158987	701158987H2	SATMONN04	g1182006	BLASTN	469	1e-39	85
356	-701160730	701160730H1	SATMONN04	g20546	BLASTN	128	1e-23	63
357	-701176142	701176142H1	SATMONN05	g1946361	BLASTN	144	1e-21	40
358	-701176323	701176323H1	SATMONN05	g2894600	BLASTN	163	1e-24	48
359	-701179810	701179810H1	SATMONN05	g2618693	BLASTN	114	1e-17	33
360	-701180481	701180481H1	SATMONN05	g532813	BLASTN	239	1e-36	59
361	-701181264	701181264H1	SATMONN06	g2911058	BLASTN	128	1e-19	45
362	1035	700077089H1	SATMON007	g1401053	BLASTN	112	1e-31	51
363	1035	700090214H1	SATMON011	g1209779	BLASTN	97	1e-30	51
364	1035	700203251H1	SATMON003	g1401053	BLASTN	97	1e-27	57

365	1035	700260407H1	SATMON017	g1401053	BLASTN	77	1e-21	53
366	1035	700431103H1	SATMONN01	g1401066	BLASTN	97	1e-21	59
367	1035	700571514H1	SATMON030	g1209779	BLASTN	97	1e-23	58
368	1035	LIB3067-003-Q1-K1-D11	LIB3067	g1209779	BLASTN	135	1e-51	48
369	10824	700026992H1	SATMON003	g2511546	BLASTN	107	1e-21	68
370	10824	700027527H1	SATMON003	g2511546	BLASTN	116	1e-22	71
371	10824	700102056H1	SATMON010	g2511546	BLASTN	107	1e-21	68
372	10824	700103281H1	SATMON010	g2511546	BLASTN	108	1e-21	68
373	10824	700204592H1	SATMON003	g2981169	BLASTN	103	1e-19	59
374	11449	700157020H1	SATMON012	g1872521	BLASTN	151	1e-30	65
375	11449	700159984H1	SATMON012	g1872521	BLASTN	151	1e-23	71
376	11477	700048922H1	SATMON003	g441220	BLASTN	495	1e-39	84
377	11477	LIB84-008-Q1-E1-F10	LIB84	g485815	BLASTN	578	1e-39	78
378	11477	LIB84-008-Q1-E1-F8	LIB84	g485815	BLASTN	457	1e-37	82
379	11715	700167124H1	SATMON013	g995854	BLASTN	184	1e-27	50
380	11715	700338785H1	SATMON020	g995854	BLASTN	181	1e-27	67
381	11824	700427090H1	SATMONN01	g2746333	BLASTN	116	1e-23	52
382	11824	700805029H1	SATMON036	g2746333	BLASTN	116	1e-19	53
383	11824	701175485H1	SATMONN05	g1321818	BLASTN	108	1e-21	50
384	12985	700152577H1	SATMON007	g2708744	BLASTN	144	1e-21	45
385	12985	700261113H1	SATMON017	g2708744	BLASTN	220	1e-33	49
386	13680	700351911H1	SATMON023	g1519680	BLASTN	132	1e-20	47
387	13763	700050261H1	SATMON003	g558542	BLASTN	235	1e-08	77
388	1432	700432237H1	SATMONN01	g1773040	BLASTN	111	1e-19	60
389	15019	700171514H1	SATMON013	g559102	BLASTN	71	1e-21	65
390	15100	700572747H1	SATMON030	g4023	BLASTN	144	1e-35	60
391	15427	700431701H1	SATMONN01	g2618752	BLASTN	231	1e-34	66
392	15427	700431705H1	SATMONN01	g2618752	BLASTN	232	1e-34	68
393	16208	700468750H1	SATMON025	g1872521	BLASTN	111	1e-23	70
394	16208	LIB143-057-Q1-E1-C3	LIB143	g1872521	BLASTN	121	1e-41	60
395	16208	LIB148-018-Q1-E1-D8	LIB148	g1872521	BLASTN	152	1e-48	63
396	16208	LIB3066-038-Q1-K1-D2	LIB3066	g1872521	BLASTN	135	1e-40	61
397	16918	700043104H1	SATMON004	g2746333	BLASTN	142	1e-21	52
398	16918	700044140H1	SATMON004	g1321818	BLASTN	142	1e-21	52
399	16918	700549778H1	SATMON022	g2746333	BLASTN	172	1e-25	50
400	16918	700551474H1	SATMON022	g2746333	BLASTN	159	1e-23	53
401	17154	700159007H1	SATMON012	g2911058	BLASTN	311	1e-44	63
402	17154	700581847H1	SATMON031	g2911058	BLASTN	298	1e-43	60
403	17154	700581848H1	SATMON031	g2911058	BLASTN	150	1e-36	57
404	17200	700161005H1	SATMON012	g2911058	BLASTN	141	1e-21	75
405	18363	700102068H1	SATMON010	g1304599	BLASTN	107	1e-20	54
406	18363	700235979H1	SATMON010	g1304599	BLASTN	227	1e-33	54
407	18643	700088171H1	SATMON011	g2582645	BLASTN	206	1e-30	78
408	18643	700552484H1	SATMON022	g2582645	BLASTN	112	1e-17	79
409	18643	701163712H1	SATMONN04	g2582645	BLASTN	136	1e-38	76
410	18643	701171379H2	SATMONN05	g2582645	BLASTN	182	1e-32	72
411	18643	LIB3060-042-Q1-K1-C3	LIB3060	g2582644	BLASTN	449	1e-27	72

412	1870	700018305H1	SATMON001	g1182006	BLASTN	781	1e-56	91
413	1870	700020004H1	SATMON001	g1182006	BLASTN	623	1e-43	88
414	1870	700020158H1	SATMON001	g1182006	BLASTN	760	1e-55	88
415	1870	700021541H1	SATMON001	g732811	BLASTN	179	1e-28	100
416	1870	700026616H1	SATMON003	g1182006	BLASTN	387	1e-24	87
417	1870	700029430H1	SATMON003	g1182006	BLASTN	772	1e-56	87
418	1870	700029830H1	SATMON003	g1182006	BLASTN	790	1e-57	87
419	1870	700047759H1	SATMON003	g1182006	BLASTN	760	1e-70	88
420	1870	700082430H1	SATMON011	g1182006	BLASTN	633	1e-44	82
421	1870	700084430H1	SATMON011	g1182006	BLASTN	911	1e-69	85
422	1870	700085075H1	SATMON011	g1182006	BLASTN	447	1e-27	84
423	1870	700087465H1	SATMON011	g1182006	BLASTN	763	1e-55	82
424	1870	700105379H1	SATMON010	g1182006	BLASTN	876	1e-65	85
425	1870	700150246H1	SATMON007	g1182006	BLASTN	510	1e-33	88
426	1870	700201345H1	SATMON003	g1182006	BLASTN	965	1e-74	87
427	1870	700202069H1	SATMON003	g1182006	BLASTN	926	1e-70	89
428	1870	700217723H1	SATMON016	g1182006	BLASTN	665	1e-56	91
429	1870	700237291H1	SATMON010	g1182006	BLASTN	747	1e-54	88
430	1870	700340470H1	SATMON020	g1182006	BLASTN	816	1e-60	84
431	1870	700341616H1	SATMON020	g1182006	BLASTN	526	1e-34	82
432	1870	700353508H1	SATMON024	g1182006	BLASTN	980	1e-75	85
433	1870	700426268H1	SATMONN01	g1182006	BLASTN	927	1e-70	86
434	1870	700446271H1	SATMON027	g1182006	BLASTN	892	1e-66	84
435	1870	700446372H1	SATMON027	g1182006	BLASTN	642	1e-45	87
436	1870	700449457H1	SATMON028	g1182006	BLASTN	621	1e-43	82
437	1870	700449903H1	SATMON028	g1182006	BLASTN	760	1e-55	87
438	1870	700452486H1	SATMON028	g1182006	BLASTN	612	1e-54	90
439	1870	700453241H1	SATMON028	g1182006	BLASTN	692	1e-49	87
440	1870	700572095H1	SATMON030	g1182006	BLASTN	414	1e-25	88
441	1870	700572123H1	SATMON030	g1182006	BLASTN	829	1e-61	82
442	1870	700572323H1	SATMON030	g1182006	BLASTN	585	1e-38	83
443	1870	700572910H1	SATMON030	g1182006	BLASTN	278	1e-14	84
444	1870	700572933H1	SATMON030	g1182006	BLASTN	893	1e-67	84
445	1870	700572946H1	SATMON030	g1182006	BLASTN	525	1e-47	87
446	1870	700573249H1	SATMON030	g1182006	BLASTN	931	1e-71	82
447	1870	700576123H1	SATMON030	g1182006	BLASTN	906	1e-68	83
448	1870	700582788H1	SATMON031	g732811	BLASTN	85	1e-35	89
449	1870	700622147H1	SATMON034	g1182006	BLASTN	570	1e-54	83
450	1870	700622250H1	SATMON034	g1182006	BLASTN	779	1e-56	84
451	1870	700622392H1	SATMON034	g1182006	BLASTN	579	1e-47	87
452	1870	700624362H1	SATMON034	g732811	BLASTN	152	1e-38	98
453	1870	700804615H1	SATMON036	g1182006	BLASTN	761	1e-55	87
454	1870	700806127H1	SATMON036	g1182006	BLASTN	643	1e-45	88
455	1870	701163755H1	SATMONN04	g1182006	BLASTN	731	1e-52	87
456	1870	701166834H1	SATMONN04	g1182006	BLASTN	364	1e-51	88
457	1870	701182594H1	SATMONN06	g1182006	BLASTN	616	1e-50	86
458	1870	LIB143-004-Q1-E1-H5	LIB143	g1182006	BLASTN	921	1e-70	87
459	1870	LIB143-008-Q1-E1-D11	LIB143	g1182006	BLASTN	285	1e-27	81
460	1870	LIB3059-041-Q1-K1-H6	LIB3059	g1182006	BLASTN	790	1e-56	83
461	1870	LIB3059-033-Q1-K1-F8	LIB3059	g1182006	BLASTN	628	1e-42	82

462	1870	LIB3061-022-Q1-K1-A3	LIB3061	g1182006	BLASTN	965	1e-74	87
463	1870	LIB3061-045-Q1-K1-E4	LIB3061	g1182006	BLASTN	888	1e-66	84
464	1870	LIB3061-048-Q1-K1-C1	LIB3061	g1182006	BLASTN	888	1e-66	84
465	1870	LIB3067-040-Q1-K1-B9	LIB3067	g1182006	BLASTN	936	1e-71	88
466	1870	LIB3067-033-Q1-K1-G7	LIB3067	g1182006	BLASTN	974	1e-74	88
467	1870	LIB3067-053-Q1-K1-H1	LIB3067	g1182006	BLASTN	872	1e-65	86
468	1870	LIB3069-008-Q1-K1-F4	LIB3069	g1182006	BLASTN	888	1e-66	84
469	1870	LIB3069-026-Q1-K1-D10	LIB3069	g1182006	BLASTN	902	1e-68	85
470	1870	LIB3078-007-Q1-K1-E5	LIB3078	g1182006	BLASTN	906	1e-68	84
471	1870	LIB3078-039-Q1-K1-D5	LIB3078	g1182006	BLASTN	893	1e-67	84
472	1870	LIB36-014-Q1-E1-C9	LIB36	g1182006	BLASTN	720	1e-50	84
473	1870	LIB83-015-Q1-E1-F2	LIB83	g1182006	BLASTN	893	1e-67	84
474	1870	LIB84-025-Q1-E1-F7	LIB84	g1182006	BLASTN	411	1e-28	88
475	19382	700258847H1	SATMON017	g1872521	BLASTN	141	1e-25	58
476	19382	700423860H1	SATMONN01	g1872521	BLASTN	152	1e-34	63
477	19599	700569343H1	SATMON030	g2582645	BLASTN	76	1e-20	82
478	19820	700215466H1	SATMON016	g1773040	BLASTN	119	1e-18	62
479	19820	700470380H1	SATMON025	g1773040	BLASTN	129	1e-19	69
480	2055	700441860H1	SATMON026	g1321818	BLASTN	127	1e-22	51
481	21017	700211455H1	SATMON016	g2960035	BLASTN	122	1e-23	47
482	21113	700382252H1	SATMON024	g1946361	BLASTN	111	1e-19	36
483	21118	700244059H1	SATMON010	g2435518	BLASTN	122	1e-26	73
484	21298	700048701H1	SATMON003	g2582645	BLASTN	176	1e-32	77
485	21298	700095050H1	SATMON008	g2582645	BLASTN	189	1e-28	78
486	21298	700101269H1	SATMON009	g2582644	BLASTN	524	1e-33	73
487	21298	700151889H1	SATMON007	g2582645	BLASTN	226	1e-34	78
488	21460	700083781H1	SATMON011	g2582643	BLASTN	94	1e-21	85
489	21460	700162856H1	SATMON013	g2582643	BLASTN	94	1e-20	90
490	22148	700582334H1	SATMON031	g2911058	BLASTN	275	1e-43	63
491	22241	700465691H1	SATMON025	g2708744	BLASTN	107	1e-18	38
492	22241	700466091H1	SATMON025	g2708744	BLASTN	106	1e-26	41
493	23254	701178810H1	SATMONN05	g924620	BLASTN	172	1e-37	56
494	23254	701179020H1	SATMONN05	g924620	BLASTN	204	1e-30	48
495	24947	700612580H1	SATMON033	g1438877	BLASTN	151	1e-22	43
496	24947	701166350H1	SATMONN04	g1438877	BLASTN	166	1e-24	41
497	24947	LIB3060-010-Q1-K1-A4	LIB3060	g1438877	BLASTN	162	1e-43	40
498	24947	LIB3067-048-Q1-K1-D6	LIB3067	g1438877	BLASTN	153	1e-37	43
499	26135	LIB3062-035-Q1-K1-F5	LIB3062	g558542	BLASTN	308	1e-14	67

500	27359	700030456H1	SATMON003	g3033388	BLASTN	204	1e-30	62
501	28039	700193021H1	SATMON014	g2827537	BLASTN	98	1e-17	78
502	28039	LIB143-066-Q1-E1-D11	LIB143	g2827537	BLASTN	98	1e-38	57
503	2972	700204107H1	SATMON003	g1872521	BLASTN	149	1e-22	64
504	2972	700215661H1	SATMON016	g1872523	BLASTN	149	1e-25	62
505	2972	700242431H1	SATMON010	g1872521	BLASTN	149	1e-37	65
506	2972	700343436H1	SATMON021	g1872521	BLASTN	149	1e-30	65
507	2972	700352888H1	SATMON024	g1872521	BLASTN	146	1e-33	69
508	2972	700382460H1	SATMON024	g1872521	BLASTN	149	1e-30	69
509	2972	700579507H1	SATMON031	g1872521	BLASTN	135	1e-23	59
510	30492	700576046H1	SATMON030	g2746333	BLASTN	121	1e-21	53
511	30619	LIB3067-019-Q1-K1-G10	LIB3067	g1438877	BLASTN	102	1e-36	48
512	31779	700439823H1	SATMON026	g2911058	BLASTN	145	1e-25	54
513	31780	LIB3066-006-Q1-K1-B8	LIB3066	g2435518	BLASTN	205	1e-59	49
514	31839	700443745H1	SATMON027	g2827537	BLASTN	155	1e-28	61
515	31839	LIB3061-001-Q1-K2-F2	LIB3061	g2827537	BLASTN	155	1e-50	65
516	3203	700042448H1	SATMON004	g1872523	BLASTN	83	1e-20	75
517	3203	LIB189-024-Q1-E1-B3	LIB189	g1872521	BLASTN	92	1e-40	70
518	3203	LIB3062-003-Q1-K1-F4	LIB3062	g1872521	BLASTN	83	1e-40	61
519	3203	LIB3078-034-Q1-K1-G8	LIB3078	g1872521	BLASTN	83	1e-34	71
520	32258	LIB3062-024-Q1-K1-H10	LIB3062	g3152606	BLASTN	159	1e-53	61
521	32618	700164830H1	SATMON013	g2746335	BLASTN	164	1e-24	56
522	32618	LIB83-002-Q1-E1-A11	LIB83	g1321818	BLASTN	180	1e-42	50
523	4116	700021533H1	SATMON001	g18819	BLASTN	310	1e-47	77
524	4116	700021703H1	SATMON001	g18819	BLASTN	336	1e-50	78
525	4116	700088936H1	SATMON011	g18819	BLASTN	225	1e-33	62
526	4116	700104150H1	SATMON010	g18819	BLASTN	374	1e-55	74
527	4116	700155735H1	SATMON007	g18819	BLASTN	262	1e-39	74
528	4116	700163155H1	SATMON013	g18819	BLASTN	321	1e-48	78
529	4116	700164940H1	SATMON013	g18819	BLASTN	313	1e-47	75
530	4116	700167001H1	SATMON013	g18819	BLASTN	319	1e-48	77
531	4116	700169123H1	SATMON013	g18819	BLASTN	214	1e-32	76
532	4116	700172257H1	SATMON013	g18819	BLASTN	290	1e-44	76
533	4116	700208410H1	SATMON016	g18819	BLASTN	126	1e-21	78
534	4116	700214491H1	SATMON016	g18819	BLASTN	144	1e-22	75
535	4116	700217884H1	SATMON016	g18819	BLASTN	287	1e-43	78
536	4116	700218119H1	SATMON016	g18819	BLASTN	336	1e-50	77
537	4116	700220941H1	SATMON011	g18819	BLASTN	262	1e-39	75
538	4116	700221214H1	SATMON011	g18819	BLASTN	245	1e-45	77
539	4116	700223354H1	SATMON011	g18819	BLASTN	325	1e-49	78
540	4116	700239456H1	SATMON010	g18819	BLASTN	328	1e-49	70
541	4116	700332271H1	SATMON019	g18819	BLASTN	371	1e-55	78
542	4116	700334087H1	SATMON019	g18819	BLASTN	267	1e-48	75
543	4116	700334247H1	SATMON019	g18819	BLASTN	207	1e-31	77
544	4116	700348818H1	SATMON023	g18819	BLASTN	354	1e-53	77

545	4116	700350932H1	SATMON023	g18819	BLASTN	199	1e-42	64
546	4116	700352473H1	SATMON023	g18819	BLASTN	256	1e-38	65
547	4116	700553074H1	SATMON022	g18819	BLASTN	86	1e-26	67
548	4116	700553178H1	SATMON022	g18819	BLASTN	202	1e-36	73
549	4116	700571301H1	SATMON030	g18819	BLASTN	326	1e-55	60
550	4116	700614281H1	SATMON033	g18819	BLASTN	142	1e-53	69
551	4116	701165130H1	SATMONN04	g18819	BLASTN	230	1e-39	73
552	4116	LIB143-010-Q1-E1-B7	LIB143	g18819	BLASTN	365	1e-82	71
553	4116	LIB3062-039-Q1-K1-A5	LIB3062	g18819	BLASTN	373	1e-75	71
554	4116	LIB3069-020-Q1-K1-E12	LIB3069	g18819	BLASTN	265	1e-63	51
555	4334	LIB3062-030-Q1-K1-A5	LIB3062	g18819	BLASTN	93	1e-35	66
556	452	700045837H1	SATMON004	g2582645	BLASTN	203	1e-30	77
557	452	700083915H1	SATMON011	g2582645	BLASTN	221	1e-45	79
558	452	700096028H1	SATMON008	g2582645	BLASTN	207	1e-34	73
559	452	700156370H1	SATMON007	g2582645	BLASTN	214	1e-45	77
560	452	700203270H1	SATMON003	g2582643	BLASTN	218	1e-47	75
561	452	700203527H1	SATMON003	g2582645	BLASTN	182	1e-29	82
562	452	700218584H1	SATMON011	g2582645	BLASTN	111	1e-19	81
563	452	700334194H1	SATMON019	g2582645	BLASTN	168	1e-25	76
564	452	700351576H1	SATMON023	g2582645	BLASTN	138	1e-37	70
565	452	700378354H1	SATMON019	g2582643	BLASTN	212	1e-42	72
566	452	700429589H1	SATMONN01	g2582645	BLASTN	120	1e-18	79
567	452	700441669H1	SATMON026	g2582645	BLASTN	220	1e-35	78
568	452	700442551H1	SATMON026	g2582645	BLASTN	214	1e-35	74
569	452	700442588H1	SATMON026	g2582645	BLASTN	208	1e-31	73
570	452	700474743H1	SATMON025	g2582645	BLASTN	127	1e-27	63
571	452	700475070H1	SATMON025	g2582645	BLASTN	211	1e-31	76
572	452	700475920H1	SATMON025	g2582645	BLASTN	123	1e-40	76
573	452	700622239H1	SATMON034	g2582645	BLASTN	214	1e-45	76
574	452	700801114H1	SATMON036	g2582645	BLASTN	198	1e-29	81
575	452	700801146H1	SATMON036	g2582645	BLASTN	160	1e-24	71
576	452	701185466H1	SATMONN06	g2582645	BLASTN	177	1e-26	72
577	452	LIB143-023-Q1-E1-A7	LIB143	g2582643	BLASTN	208	1e-51	58
578	4605	700345737H1	SATMON021	g1001957	BLASTN	84	1e-17	40
579	4959	700029702H1	SATMON003	g2738449	BLASTN	124	1e-19	38
580	4959	700030133H1	SATMON003	g2738449	BLASTN	125	1e-19	36
581	4959	700159379H1	SATMON012	g2738449	BLASTN	114	1e-17	44
582	4959	700215552H1	SATMON016	g2738449	BLASTN	112	1e-17	44
583	4959	700235857H1	SATMON010	g2738449	BLASTN	124	1e-19	38
584	4959	700548858H1	SATMON022	g2738449	BLASTN	117	1e-18	43
585	5352	700094269H1	SATMON008	g2708744	BLASTN	278	1e-40	49
586	7136	700801832H1	SATMON036	g732811	BLASTN	77	1e-26	76
587	7136	700803283H1	SATMON036	g732811	BLASTN	77	1e-26	76
588	7965	700202917H1	SATMON003	g558543	BLASTN	120	1e-18	61
589	8800	700549224H1	SATMON022	g1707154	BLASTN	77	1e-18	54
590	8800	700549324H1	SATMON022	g1707154	BLASTN	78	1e-19	56
591	8895	700215423H1	SATMON016	g1871192	BLASTN	134	1e-27	53
592	8895	700265383H1	SATMON017	g1871192	BLASTN	84	1e-20	44
593	8929	700161625H1	SATMON012	g2582645	BLASTN	130	1e-20	78

594	8929	700433751H1	SATMONN01	g2582643	BLASTN	131	1e-20	64
595	8929	LIB3062-044-Q1-K1-A11	LIB3062	g2582644	BLASTN	534	1e-43	75
596	9711	700142473H1	SATMON012	g2982466	BLASTN	131	1e-20	48

MAIZE OTHER TRANSCRIPTION FACTORS

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597	-700019575	700019575H1	SATMON001	g1183866	BLASTN	177	1e-32	81
598	-700019871	700019871H1	SATMON001	g1370276	BLASTN	122	1e-18	48
599	-700020149	700020149H1	SATMON001	g786426	BLASTN	184	1e-27	90
600	-700021543	700021543H1	SATMON001	g671868	BLASTN	114	1e-17	91
601	-700026214	700026214H1	SATMON003	g21634	BLASTN	234	1e-08	93
602	-700026342	700026342H1	SATMON003	g1946264	BLASTN	730	1e-52	86
603	-700026663	700026663H1	SATMON003	g19490	BLASTN	166	1e-25	56
604	-700026811	700026811H1	SATMON003	g2338034	BLASTN	46	1e-17	39
605	-700027164	700027164H1	SATMON003	g2145358	BLASTN	136	1e-36	65
606	-700027449	700027449H1	SATMON003	g1002796	BLASTN	98	1e-18	76
607	-700028188	700028188H1	SATMON003	g2145358	BLASTN	161	1e-40	68
608	-700028533	700028533H1	SATMON003	g556408	BLASTN	1062	1e-79	85
609	-700046037	700046037H1	SATMON004	g22614	BLASTN	287	1e-13	74
610	-700049432	700049432H1	SATMON003	g1420923	BLASTN	381	1e-44	76
611	-700049692	700049692H1	SATMON003	g1430846	BLASTN	114	1e-19	56
612	-700050495	700050495H1	SATMON003	g996020	BLASTN	112	1e-20	65
613	-700051531	700051531H1	SATMON003	g2245390	BLASTN	192	1e-39	66
614	-700052158	700052158H1	SATMON003	g1002800	BLASTN	130	1e-28	80
615	-700053658	700053658H1	SATMON010	g556557	BLASTN	825	1e-59	86
616	-700075928	700075928H1	SATMON007	g2104685	BLASTN	172	1e-25	67
617	-700076670	700076670H1	SATMON007	g2826882	BLASTN	129	1e-21	54
618	-700082219	700082219H1	SATMON011	g2062176	BLASTN	177	1e-26	61
619	-700082978	700082978H1	SATMON011	g2104678	BLASTN	806	1e-58	75
620	-700083837	700083837H1	SATMON011	g2398532	BLASTN	686	1e-48	76
621	-700084491	700084491H1	SATMON011	g940880	BLASTN	360	1e-19	84
622	-700084907	700084907H1	SATMON011	g2104678	BLASTN	335	1e-36	76
623	-700084920	700084920H1	SATMON011	g1183865	BLASTN	259	1e-10	74
624	-700085504	700085504H1	SATMON011	g2914703	BLASTN	313	1e-45	56
625	-700086685	700086685H1	SATMON011	g1749546	BLASTN	117	1e-27	53
626	-700090877	700090877H1	SATMON011	g1666172	BLASTN	241	1e-09	73
627	-700092059	700092059H1	SATMON008	g671867	BLASTN	194	1e-29	80
628	-700093458	700093458H1	SATMON008	g2104679	BLASTN	124	1e-19	42
629	-700093517	700093517H1	SATMON008	g841308	BLASTN	90	1e-20	53
630	-700095187	700095187H1	SATMON008	g2145358	BLASTN	107	1e-29	65
631	-700095891	700095891H1	SATMON008	g2565210	BLASTN	129	1e-19	30
632	-700095949	700095949H1	SATMON008	g556557	BLASTN	230	1e-10	79
633	-700099947	700099947H1	SATMON009	g214819	BLASTN	90	1e-26	40
634	-700101582	700101582H1	SATMON009	g218338	BLASTN	278	1e-40	85
635	-700102210	700102210H1	SATMON010	g19491	BLASTN	565	1e-38	74
636	-700102430	700102430H1	SATMON010	g1946264	BLASTN	638	1e-44	85
637	-700103072	700103072H1	SATMON010	g928967	BLASTN	131	1e-37	83
638	-700104061	700104061H1	SATMON010	g556557	BLASTN	698	1e-85	83
639	-700106380	700106380H1	SATMON010	g556409	BLASTN	112	1e-17	88
640	-700106429	700106429H1	SATMON010	g2160167	BLASTN	168	1e-25	85
641	-700106570	700106570H1	SATMON010	g2104678	BLASTN	490	1e-30	76

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696	-700336375	700336375H1	SATMON019	g307512	BLASTN	116	1e-17	57
697	-700337421	700337421H1	SATMON020	g22192	BLASTN	373	1e-20	78
698	-700343163	700343163H1	SATMON021	g2673911	BLASTN	93	1e-27	64
699	-700344051	700344051H1	SATMON021	g2196465	BLASTN	356	1e-19	71
700	-700345378	700345378H1	SATMON021	g2460124	BLASTN	120	1e-20	67
701	-700350143	700350143H1	SATMON023	g1905933	BLASTN	521	1e-62	92
702	-700350565	700350565H1	SATMON023	g854644	BLASTN	369	1e-55	96
703	-700351026	700351026H1	SATMON023	g2145358	BLASTN	190	1e-41	81
704	-700355409	700355409H1	SATMON024	g2088643	BLASTN	106	1e-20	59
705	-700356229	700356229H1	SATMON024	g939780	BLASTN	377	1e-54	96
706	-700383190	700383190H1	SATMON024	g886400	BLASTN	864	1e-63	85
707	-700397574	700397574H1	SATMONN01	g786426	BLASTN	155	1e-23	61
708	-700421862	700421862H1	SATMONN01	g2443887	BLASTN	100	1e-18	35
709	-700422263	700422263H1	SATMONN01	g1931638	BLASTN	142	1e-21	70
710	-700422519	700422519H1	SATMONN01	g2832406	BLASTN	196	1e-29	59
711	-700438102	700438102H1	SATMON026	g945086	BLASTN	205	1e-16	78
712	-700438243	700438243H1	SATMON026	g290057	BLASTN	107	1e-29	90
713	-700439444	700439444H1	SATMON026	g2062176	BLASTN	253	1e-37	72
714	-700441743	700441743H1	SATMON026	g2398533	BLASTN	92	1e-39	76
715	-700445068	700445068H1	SATMON027	g2245059	BLASTN	248	1e-38	66
716	-700445278	700445278H1	SATMON027	g1658504	BLASTN	128	1e-19	58
717	-700445763	700445763H1	SATMON027	g2623247	BLASTN	375	1e-20	94
718	-700450354	700450354H1	SATMON028	g1946266	BLASTN	450	1e-27	74
719	-700450456	700450456H1	SATMON028	g939784	BLASTN	307	1e-14	91
720	-700450661	700450661H1	SATMON028	g22379	BLASTN	344	1e-19	82
721	-700452911	700452911H1	SATMON028	g19490	BLASTN	114	1e-17	50
722	-700454133	700454133H1	SATMON029	g497895	BLASTN	145	1e-21	69
723	-700455972	700455972H1	SATMON029	g1109830	BLASTN	148	1e-22	45
724	-700456486	700456486H1	SATMON029	g662931	BLASTN	442	1e-26	72
725	-700457355	700457355H1	SATMON029	g2997755	BLASTN	155	1e-23	53
726	-700458137	700458137H1	SATMON029	g556557	BLASTN	222	1e-40	89
727	-700468802	700468802H1	SATMON025	g2104683	BLASTN	92	1e-20	42
728	-700471323	700471323H1	SATMON025	g2264318	BLASTN	362	1e-19	77
729	-700474747	700474747H1	SATMON025	g2735839	BLASTN	711	1e-72	93
730	-700475624	700475624H1	SATMON025	g2245390	BLASTN	104	1e-33	71
731	-700476829	700476829H1	SATMON025	g712839	BLASTN	102	1e-17	50
732	-700477049	700477049H1	SATMON025	g1109830	BLASTN	191	1e-38	59
733	-700479575	700479575H1	SATMON034	g19260	BLASTN	122	1e-18	54
734	-700550479	700550479H1	SATMON022	g2257568	BLASTN	200	1e-29	51
735	-700551414	700551414H1	SATMON022	g2245390	BLASTN	109	1e-25	57
736	-700551996	700551996H1	SATMON022	g2735839	BLASTN	969	1e-82	89
737	-700570447	700570447H1	SATMON030	g1334687	BLASTN	112	1e-23	42

750	-700616291	700616291H1	SATMON033	g2791686	BLASTN	94	1e-31	75
751	-700616301	700616301H1	SATMON033	g500716	BLASTN	88	1e-21	40
752	-700618172	700618172H1	SATMON033	g2826884	BLASTN	92	1e-20	65
753	-700621627	700621627H1	SATMON034	g928940	BLASTN	261	1e-29	79
754	-700622876	700622876H1	SATMON034	g556558	BLASTN	85	1e-18	73
755	-700801070	700801070H1	SATMON036	g1232130	BLASTN	184	1e-34	67
756	-700801770	700801770H1	SATMON036	g2735839	BLASTN	610	1e-77	89
757	-700805033	700805033H1	SATMON036	g2245059	BLASTN	222	1e-34	71
758	-700807208	700807208H1	SATMON036	g940880	BLASTN	249	1e-09	66
759	-701158984	701158984H2	SATMONN04	g2245390	BLASTN	117	1e-18	79
760	-701160396	701160396H1	SATMONN04	g1017722	BLASTN	137	1e-20	39
761	-701162944	701162944H1	SATMONN04	g2104680	BLASTN	322	1e-16	76
762	-701163605	701163605H1	SATMONN04	g945087	BLASTN	118	1e-18	74
763	-701163909	701163909H1	SATMONN04	g945087	BLASTN	106	1e-26	74
764	-701164109	701164109H1	SATMONN04	g945087	BLASTN	181	1e-27	69
765	-701166305	701166305H1	SATMONN04	g791053	BLASTN	120	1e-19	68
766	-701166764	701166764H1	SATMONN04	g786426	BLASTN	89	1e-17	59
767	-701166991	701166991H1	SATMONN04	g786426	BLASTN	81	1e-19	43
768	-701167666	701167666H1	SATMONN05	g2735839	BLASTN	322	1e-16	60
769	-701169152	701169152H1	SATMONN05	g1838975	BLASTN	442	1e-26	69
770	-701176332	701176332H1	SATMONN05	g2865393	BLASTN	893	1e-98	95
771	-701176532	701176532H1	SATMONN05	g1946266	BLASTN	596	1e-40	73
772	-701177470	701177470H1	SATMONN05	g786426	BLASTN	160	1e-33	72
773	-701178415	701178415H1	SATMONN05	g1663706	BLASTN	119	1e-18	45
774	-701181844	701181844H1	SATMONN06	g309567	BLASTN	261	1e-17	73
775	-701182022	701182022H1	SATMONN06	g2735839	BLASTN	804	1e-73	94
776	10841	700354175H1	SATMON024	g886400	BLASTN	608	1e-41	85
777	11048	700091161H1	SATMON011	g22379	BLASTN	815	1e-118	99
778	11048	700094225H1	SATMON008	g22379	BLASTN	1254	1e-96	94
779	11048	LIB3066-048- Q1-K1-B3	LIB3066	g22379	BLASTN	1336	1e-140	96
780	1132	700016293H1	SATMON001	g2104681	BLASTN	149	1e-21	72
781	1132	700030344H1	SATMON003	g2104681	BLASTN	149	1e-22	72
782	1132	700044121H1	SATMON004	g2245037	BLASTN	80	1e-20	80
783	1132	700074952H1	SATMON007	g2104680	BLASTN	261	1e-10	67
784	1132	700083435H1	SATMON011	g2104681	BLASTN	178	1e-31	69
785	1132	700086305H1	SATMON011	g2104681	BLASTN	149	1e-21	72
786	1132	700086644H1	SATMON011	g2245037	BLASTN	82	1e-20	78
787	1132	700086711H1	SATMON011	g2104681	BLASTN	103	1e-21	68
788	1132	700087425H1	SATMON011	g2104681	BLASTN	149	1e-22	72
789	1132	700090989H1	SATMON011	g2104681	BLASTN	116	1e-17	75
790	1132	700154203H1	SATMON007	g2245037	BLASTN	117	1e-19	62
791	1132	700154842H1	SATMON007	g2104681	BLASTN	116	1e-19	72
792	1132	700158381H1	SATMON012	g2104681	BLASTN	105	1e-18	69
793	1132	700202205H1	SATMON003	g2104681	BLASTN	133	1e-26	55
794	1132	700212439H1	SATMON016	g2104681	BLASTN	157	1e-22	73
795	1132	700214363H1	SATMON016	g2104681	BLASTN	149	1e-21	72
796	1132	700218135H1	SATMON016	g2104681	BLASTN	99	1e-21	71
797	1132	700218926H1	SATMON011	g2104681	BLASTN	176	1e-30	68
798	1132	700218975H1	SATMON011	g2104680	BLASTN	256	1e-12	70
799	1132	700220843H1	SATMON011	g2104681	BLASTN	149	1e-21	72
800	1132	700332959H1	SATMON019	g2104681	BLASTN	162	1e-27	65
801	1132	700341508H1	SATMON020	g2104681	BLASTN	104	1e-21	72
802	1132	700342724H1	SATMON021	g2104681	BLASTN	99	1e-21	71

803	1132	700379133H1	SATMON020	g2104681	BLASTN	181	1e-27	67
804	1132	700379623H1	SATMON021	g2104681	BLASTN	204	1e-35	68
805	1132	700381233H1	SATMON023	g2104681	BLASTN	178	1e-30	68
806	1132	700428163H1	SATMONN01	g2104681	BLASTN	158	1e-28	56
807	1132	700550895H1	SATMON022	g2104681	BLASTN	149	1e-21	72
808	1132	700571669H1	SATMON030	g2104680	BLASTN	243	1e-09	68
809	1132	701172936H2	SATMONN05	g2104680	BLASTN	286	1e-12	62
810	1132	LIB143-012- Q1-E1-C3	LIB143	g2104681	BLASTN	149	1e-37	72
811	1132	LIB143-040- Q1-E1-H12	LIB143	g2104681	BLASTN	161	1e-45	70
812	1132	LIB143-051- Q1-E1-F1	LIB143	g2104681	BLASTN	94	1e-44	68
813	1132	LIB3059-053- Q1-K1-C9	LIB3059	g2104680	BLASTN	255	1e-17	76
814	1132	LIB84-017- Q1-E1-A12	LIB84	g2104681	BLASTN	143	1e-37	70
815	11643	700150626H1	SATMON007	g556408	BLASTN	520	1e-34	74
816	11643	700379992H1	SATMON021	g556409	BLASTN	96	1e-21	60
817	11643	700447471H1	SATMON027	g556409	BLASTN	221	1e-37	79
818	11643	700578312H1	SATMON031	g556409	BLASTN	201	1e-31	85
819	11643	700578412H1	SATMON031	g556409	BLASTN	190	1e-31	85
820	11643	700579885H1	SATMON031	g556409	BLASTN	182	1e-32	71
821	11643	LIB3078-052- Q1-K1-G4	LIB3078	g556408	BLASTN	456	1e-26	71
822	11816	700153106H1	SATMON007	g458966	BLASTN	192	1e-28	80
823	11816	LIB3060-035- Q1-K1-C12	LIB3060	g458966	BLASTN	374	1e-72	57
824	11817	700082505H1	SATMON011	g2735839	BLASTN	577	1e-64	87
825	11817	700804825H1	SATMON036	g2735839	BLASTN	437	1e-33	96
826	11817	701186081H1	SATMONN06	g2735839	BLASTN	993	1e-83	96
827	11817	LIB3062-043- Q1-K1-C6	LIB3062	g2735839	BLASTN	971	1e-147	95
828	11912	700029540H1	SATMON003	g945086	BLASTN	385	1e-47	86
829	11912	700088190H1	SATMON011	g945086	BLASTN	638	1e-44	85
830	11912	700202293H1	SATMON003	g945087	BLASTN	162	1e-24	75
831	11912	700238151H1	SATMON010	g945086	BLASTN	259	1e-10	81
832	11912	700333803H1	SATMON019	g945086	BLASTN	276	1e-28	80
833	11912	700349774H1	SATMON023	g945086	BLASTN	635	1e-44	85
834	11912	700622017H1	SATMON034	g945086	BLASTN	499	1e-38	85
835	11912	700622588H1	SATMON034	g945086	BLASTN	776	1e-59	84
836	11912	700799161H1	SATMON036	g945086	BLASTN	486	1e-40	84
837	11964	LIB83-016- Q1-E1-E1	LIB83	g2961085	BLASTN	248	1e-52	48
838	12088	700089512H1	SATMON011	g2826884	BLASTN	94	1e-22	56
839	12088	700467762H1	SATMON025	g2826884	BLASTN	94	1e-22	56
840	12088	700469512H1	SATMON025	g2826884	BLASTN	86	1e-20	50
841	12088	LIB3067-001- Q1-K1-D2	LIB3067	g1429226	BLASTN	69	1e-33	55
842	1213	700331889H1	SATMON019	g291504	BLASTN	44	1e-17	47
843	12161	700168246H1	SATMON013	g2145358	BLASTN	291	1e-42	72
844	12374	700171613H1	SATMON013	g2894561	BLASTN	212	1e-33	69
845	12374	700171646H1	SATMON013	g2894563	BLASTN	209	1e-32	64
846	12374	700441607H1	SATMON026	g2894563	BLASTN	211	1e-33	55

847	12389	700345009H1	SATMON021	g1905933	BLASTN	698	1e-49	84
848	12389	700345457H1	SATMON021	g939780	BLASTN	321	1e-38	86
849	12389	700347055H1	SATMON021	g939784	BLASTN	714	1e-50	85
850	12389	700452517H1	SATMON028	g939784	BLASTN	731	1e-52	83
851	12389	700468216H1	SATMON025	g939780	BLASTN	558	1e-37	83
852	12389	700552743H1	SATMON022	g939784	BLASTN	656	1e-45	86
853	12389	LIB3062-026-Q1-K1-F3	LIB3062	g939780	BLASTN	308	1e-32	85
854	12389	LIB3069-036-Q1-K1-H9	LIB3069	g1905943	BLASTN	289	1e-13	76
855	1281	700438124H1	SATMON026	g791055	BLASTN	131	1e-24	41
856	1281	700438323H1	SATMON026	g1345437	BLASTN	70	1e-18	51
857	1281	700438324H1	SATMON026	g1345404	BLASTN	120	1e-21	46
858	13064	700220312H1	SATMON011	g2511745	BLASTN	174	1e-31	59
859	13064	700476055H1	SATMON025	g2511745	BLASTN	165	1e-24	58
860	13159	700215689H1	SATMON016	g2921823	BLASTN	196	1e-28	73
861	13159	700222611H1	SATMON011	g2921823	BLASTN	180	1e-26	70
862	13506	700258514H1	SATMON017	g458966	BLASTN	124	1e-18	59
863	13506	700550058H1	SATMON022	g458966	BLASTN	167	1e-31	55
864	13583	700240501H1	SATMON010	g2160155	BLASTN	280	1e-24	66
865	13583	700334013H1	SATMON019	g1747309	BLASTN	304	1e-35	68
866	13583	700464860H1	SATMON025	g2160155	BLASTN	247	1e-18	74
867	13719	700019216H1	SATMON001	g1666172	BLASTN	457	1e-29	78
868	13719	700027811H1	SATMON003	g1666172	BLASTN	631	1e-43	76
869	13719	700085319H1	SATMON011	g1666172	BLASTN	827	1e-60	77
870	13719	700091978H1	SATMON011	g1666172	BLASTN	776	1e-56	76
871	13719	700105364H1	SATMON010	g1666172	BLASTN	763	1e-55	76
872	13719	700166474H1	SATMON013	g1666172	BLASTN	465	1e-30	77
873	13719	700169668H1	SATMON013	g1666172	BLASTN	421	1e-25	77
874	13719	700205083H1	SATMON003	g1666172	BLASTN	732	1e-52	72
875	13719	700217819H1	SATMON016	g1666172	BLASTN	580	1e-39	78
876	13719	700261364H1	SATMON017	g1666172	BLASTN	596	1e-41	78
877	13719	700337547H1	SATMON020	g1666172	BLASTN	637	1e-44	77
878	13719	700351584H1	SATMON023	g1666173	BLASTN	136	1e-21	89
879	13719	700456150H1	SATMON029	g1666172	BLASTN	315	1e-20	78
880	13719	700569667H1	SATMON030	g2982299	BLASTN	127	1e-20	50
881	13719	700617352H1	SATMON033	g2982299	BLASTN	190	1e-29	78
882	13719	700619290H1	SATMON034	g1666172	BLASTN	414	1e-23	76
883	13719	700621490H1	SATMON034	g1666172	BLASTN	805	1e-58	78
884	13719	700703945H1	SATMON036	g2982299	BLASTN	190	1e-29	78
885	13719	LIB143-003-Q1-E1-F9	LIB143	g2982299	BLASTN	244	1e-53	65
886	13719	LIB3068-006-Q1-K1-C8	LIB3068	g1666172	BLASTN	787	1e-57	72
887	13719	LIB36-022-Q1-E1-A4	LIB36	g1666172	BLASTN	778	1e-55	72
888	1376	700020470H1	SATMON001	g1666172	BLASTN	320	1e-17	77
889	1376	700025761H1	SATMON003	g1666172	BLASTN	507	1e-33	76
890	1376	700028245H1	SATMON003	g2982298	BLASTN	717	1e-51	78
891	1376	700043653H1	SATMON004	g1666172	BLASTN	701	1e-49	80
892	1376	700046208H1	SATMON004	g1666172	BLASTN	476	1e-30	79
893	1376	700072365H1	SATMON007	g1666172	BLASTN	629	1e-43	80
894	1376	700075933H1	SATMON007	g1666172	BLASTN	645	1e-45	78
895	1376	700084617H1	SATMON011	g2982298	BLASTN	610	1e-46	76

896	1376	700092634H1	SATMON008	g1666172	BLASTN	835	1e-61	79
897	1376	700092836H1	SATMON008	g1666172	BLASTN	863	1e-63	79
898	1376	700092927H1	SATMON008	g1666172	BLASTN	909	1e-67	79
899	1376	700094657H1	SATMON008	g1666172	BLASTN	771	1e-55	80
900	1376	700096443H1	SATMON008	g1666172	BLASTN	493	1e-32	81
901	1376	700098804H1	SATMON009	g1666172	BLASTN	715	1e-51	76
902	1376	700100004H1	SATMON009	g1666172	BLASTN	692	1e-49	78
903	1376	700102738H1	SATMON010	g2982298	BLASTN	598	1e-41	74
904	1376	700157167H1	SATMON012	g2982298	BLASTN	374	1e-25	72
905	1376	700160622H1	SATMON012	g1666172	BLASTN	647	1e-45	76
906	1376	700160771H1	SATMON012	g2982298	BLASTN	649	1e-45	76
907	1376	700167008H1	SATMON013	g2982298	BLASTN	534	1e-35	73
908	1376	700167594H1	SATMON013	g1666172	BLASTN	501	1e-33	78
909	1376	700202914H1	SATMON003	g1666172	BLASTN	165	1e-08	79
910	1376	700205538H1	SATMON003	g1666172	BLASTN	658	1e-46	76
911	1376	700206442H1	SATMON003	g1666172	BLASTN	364	1e-19	70
912	1376	700207388H1	SATMON016	g1666172	BLASTN	480	1e-31	77
913	1376	700208716H1	SATMON016	g1666172	BLASTN	629	1e-43	80
914	1376	700212157H1	SATMON016	g1666172	BLASTN	374	1e-26	81
915	1376	700215562H1	SATMON016	g1666172	BLASTN	629	1e-43	80
916	1376	700216355H1	SATMON016	g1666172	BLASTN	609	1e-42	79
917	1376	700221834H1	SATMON011	g2982298	BLASTN	445	1e-31	72
918	1376	700224896H1	SATMON011	g2982299	BLASTN	166	1e-37	84
919	1376	700244238H1	SATMON010	g1666172	BLASTN	546	1e-36	79
920	1376	700332668H1	SATMON019	g1666172	BLASTN	682	1e-48	75
921	1376	700342661H1	SATMON021	g1666172	BLASTN	573	1e-39	81
922	1376	700353090H1	SATMON024	g1666172	BLASTN	507	1e-33	79
923	1376	700380279H1	SATMON021	g1666172	BLASTN	873	1e-64	78
924	1376	700451362H1	SATMON028	g1666172	BLASTN	247	1e-10	73
925	1376	700456437H1	SATMON029	g2982298	BLASTN	406	1e-31	76
926	1376	700475487H1	SATMON025	g2982298	BLASTN	590	1e-40	72
927	1376	700549437H1	SATMON022	g1666172	BLASTN	736	1e-52	78
928	1376	700575656H1	SATMON030	g1666172	BLASTN	721	1e-51	75
929	1376	700576835H1	SATMON031	g1666172	BLASTN	608	1e-42	76
930	1376	700613990H1	SATMON033	g1666172	BLASTN	314	1e-28	75
931	1376	700805417H1	SATMON036	g1666172	BLASTN	642	1e-50	80
932	1376	701158424H1	SATMONN04	g1666173	BLASTN	124	1e-23	91
933	1376	LIB143-061-Q1-E1-G4	LIB143	g1666172	BLASTN	522	1e-45	80
934	1376	LIB143-059-Q1-E1-F6	LIB143	g1666172	BLASTN	748	1e-53	79
935	1376	LIB3060-023-Q1-K1-F3	LIB3060	g1666172	BLASTN	252	1e-17	72
936	1376	LIB3061-005-Q1-K1-G1	LIB3061	g1666172	BLASTN	647	1e-52	77
937	1376	LIB3062-011-Q1-K1-F6	LIB3062	g2982298	BLASTN	472	1e-28	69
938	1376	LIB3067-018-Q1-K1-E5	LIB3067	g1666172	BLASTN	671	1e-45	77
939	1376	LIB3079-001-Q1-K1-E12	LIB3079	g1666172	BLASTN	902	1e-66	79
940	1376	LIB3079-019-Q1-K1-B12	LIB3079	g1666172	BLASTN	704	1e-48	79
941	1376	LIB36-009-	LIB36	g1666172	BLASTN	786	1e-56	78

986	16806	700575382H1	SATMON030	g19050	BLASTN	488	1e-30	69
987	16806	LIB189-022-Q1-E1-G3	LIB189	g19050	BLASTN	486	1e-29	71
988	16823	700075006H1	SATMON007	g945086	BLASTN	162	1e-19	91
989	16823	700195166H1	SATMON014	g945086	BLASTN	598	1e-67	83
990	1685	700168578H1	SATMON013	g19050	BLASTN	914	1e-67	88
991	1685	700168586H1	SATMON013	g19050	BLASTN	600	1e-61	91
992	1685	700169008H1	SATMON013	g19051	BLASTN	114	1e-24	85
993	1685	700450735H1	SATMON028	g19050	BLASTN	516	1e-66	80
994	1685	700450862H1	SATMON028	g19050	BLASTN	782	1e-70	87
995	1685	701177241H1	SATMONN05	g19050	BLASTN	1098	1e-82	89
996	17026	700224747H1	SATMON011	g1109830	BLASTN	141	1e-21	49
997	17343	700162168H1	SATMON012	g2104680	BLASTN	312	1e-15	74
998	17343	700623376H1	SATMON034	g2104680	BLASTN	388	1e-21	73
999	1752	700094001H1	SATMON008	g2145358	BLASTN	267	1e-41	83
1000	1752	700166528H1	SATMON013	g2145358	BLASTN	162	1e-26	61
1001	1752	700472134H1	SATMON025	g2145358	BLASTN	147	1e-26	69
1002	1752	700550706H1	SATMON022	g2145358	BLASTN	206	1e-39	74
1003	17589	700453469H1	SATMON028	g1922964	BLASTN	199	1e-33	72
1004	17698	700170367H1	SATMON013	g19050	BLASTN	541	1e-47	87
1005	17698	700429674H1	SATMONN01	g19050	BLASTN	529	1e-63	89
1006	17844	700549177H1	SATMON022	g2245390	BLASTN	269	1e-39	63
1007	17844	700611553H1	SATMON022	g2245390	BLASTN	210	1e-30	67
1008	18145	700263654H1	SATMON017	g1107889	BLASTN	478	1e-29	61
1009	18464	700339475H1	SATMON020	g2735839	BLASTN	477	1e-44	76
1010	1870	LIB189-032-Q1-E1-A3	LIB189	g431319	BLASTN	263	1e-56	78
1011	19066	700106876H1	SATMON010	g531901	BLASTN	146	1e-22	46
1012	19066	700424541H1	SATMONN01	g531899	BLASTN	99	1e-18	45
1013	19066	701163554H1	SATMONN04	g531897	BLASTN	151	1e-22	46
1014	19066	701177002H1	SATMONN05	g531897	BLASTN	148	1e-22	46
1015	19066	LIB3067-010-Q1-K1-A8	LIB3067	g286023	BLASTN	151	1e-38	42
1016	19264	700466662H1	SATMON025	g2253581	BLASTN	139	1e-22	52
1017	19289	700427948H1	SATMONN01	g2443887	BLASTN	303	1e-43	70
1018	19289	700428162H1	SATMONN01	g2443887	BLASTN	102	1e-20	60
1019	19289	700428194H1	SATMONN01	g2443887	BLASTN	138	1e-30	57
1020	19406	700220084H1	SATMON011	g2435529	BLASTN	257	1e-37	55
1021	19898	700352780H1	SATMON024	g1890351	BLASTN	443	1e-26	68
1022	19898	700352862H1	SATMON024	g2088643	BLASTN	126	1e-19	64
1023	19898	700354483H1	SATMON024	g1890351	BLASTN	436	1e-25	66
1024	19898	LIB148-018-Q1-E1-D2	LIB148	g1890351	BLASTN	541	1e-34	68
1025	19898	LIB148-018-Q1-E1-B10	LIB148	g1890351	BLASTN	526	1e-32	67
1026	19898	LIB148-010-Q1-E1-E3	LIB148	g1890351	BLASTN	537	1e-33	68
1027	19898	LIB148-010-Q1-E1-B2	LIB148	g2088643	BLASTN	125	1e-54	64
1028	19898	LIB148-016-Q1-E1-A11	LIB148	g1890351	BLASTN	541	1e-34	68
1029	19898	LIB148-011-Q1-E1-E4						

		Q1-E1 F3						
1031	19898	LIB148-048-Q1-E1-E4	LIB148	g1890351	BLASTN	501	1e-54	67
1032	19898	LIB148-047-Q1-E1-B7	LIB148	g1890351	BLASTN	541	1e-34	68
1033	19898	LIB148-024-Q1-E1-D11	LIB148	g1890351	BLASTN	541	1e-34	68
1034	19898	LIB148-026-Q1-E1-C12	LIB148	g1890351	BLASTN	526	1e-33	67
1035	19898	LIB148-037-Q1-E1-B6	LIB148	g1890351	BLASTN	541	1e-34	68
1036	19898	LIB148-036-Q1-E1-D4	LIB148	g1890351	BLASTN	541	1e-34	68
1037	19898	LIB148-041-Q1-E1-A7	LIB148	g1890351	BLASTN	503	1e-31	67
1038	19898	LIB148-043-Q1-E1-D6	LIB148	g1890351	BLASTN	530	1e-33	67
1039	19898	LIB148-028-Q1-E1-F5	LIB148	g1890351	BLASTN	541	1e-34	68
1040	19898	LIB148-028-Q1-E1-B8	LIB148	g1890351	BLASTN	526	1e-32	67
1041	19898	LIB148-065-Q1-E1-H11	LIB148	g1890351	BLASTN	526	1e-32	67
1042	19898	LIB3066-007-Q1-K1-G6	LIB3066	g1890351	BLASTN	541	1e-34	68
1043	19898	LIB3066-005-Q1-K1-A7	LIB3066	g1890351	BLASTN	541	1e-34	68
1044	19898	LIB3066-043-Q1-K1-C2	LIB3066	g1890351	BLASTN	515	1e-31	69
1045	19898	LIB3066-054-Q1-K1-H1	LIB3066	g1890351	BLASTN	501	1e-30	66
1046	19898	LIB3066-020-Q1-K1-A12	LIB3066	g1890351	BLASTN	526	1e-32	67
1047	19898	LIB3066-015-Q1-K1-C5	LIB3066	g1890351	BLASTN	541	1e-34	68
1048	19898	LIB3066-018-Q1-K1-H6	LIB3066	g1890351	BLASTN	541	1e-34	68
1049	19898	LIB3068-005-Q1-K1-F11	LIB3068	g1890351	BLASTN	443	1e-25	65
1050	19898	LIB3068-044-Q1-K1-F11	LIB3068	g1890351	BLASTN	476	1e-39	68
1051	19898	LIB3068-022-Q1-K1-G12	LIB3068	g1890351	BLASTN	443	1e-58	68
1052	19952	700223268H1	SATMON011	g2511745	BLASTN	76	1e-20	49
1053	19952	700263345H1	SATMON017	g2511745	BLASTN	112	1e-24	62
1054	19967	700209268H1	SATMON016	g1100994	BLASTN	124	1e-20	45
1055	19967	700349581H1	SATMON023	g893288	BLASTN	102	1e-20	56
1056	20005	LIB84-003-Q1-E1-C7	LIB84	g171580	BLASTN	81	1e-35	47
1057	20026	700071863H1	SATMON007	g1747310	BLASTN	213	1e-39	76
1058	20026	700102802H1	SATMON010	g2160155	BLASTN	650	1e-45	70
1059	20079	700164569H1	SATMON013	g556557	BLASTN	1038	1e-77	92
1060	20079	700383195H1	SATMON024	g556557	BLASTN	616	1e-87	89
1061	20373	700087468H1	SATMON011	g556559	BLASTN	976	1e-76	82

1106	24165	LIB3069-039-Q1-K1-G10	LIB3069	g1206002	BLASTN	555	1e-35	67
1107	2432	700150729H1	SATMON007	g1420923	BLASTN	250	1e-09	81
1108	2432	700344645H1	SATMON021	g1420923	BLASTN	250	1e-09	81
1109	2432	700551468H1	SATMON022	g1420923	BLASTN	250	1e-09	81
1110	24344	700352172H1	SATMON023	g951171	BLASTN	774	1e-95	96
1111	24344	LIB3059-042-Q1-K1-E7	LIB3059	g1167913	BLASTN	1972	1e-157	98
1112	24344	LIB3067-059-Q1-K1-C4	LIB3067	g951171	BLASTN	1470	1e-171	96
1113	24344	LIB3067-058-Q1-K1-F6	LIB3067	g951171	BLASTN	1841	1e-157	97
1114	24766	LIB3067-032-Q1-K1-B1	LIB3067	g508576	BLASTN	847	1e-61	75
1115	24766	LIB3067-059-Q1-K1-A11	LIB3067	g508576	BLASTN	720	1e-51	80
1116	24766	LIB3069-031-Q1-K1-H4	LIB3069	g508576	BLASTN	633	1e-42	81
1117	25149	700045930H1	SATMON004	g2826884	BLASTN	148	1e-24	50
1118	25149	700470039H1	SATMON025	g2826884	BLASTN	167	1e-25	56
1119	25149	LIB3059-035-Q1-K1-H9	LIB3059	g2826884	BLASTN	180	1e-52	57
1120	25399	700258915H1	SATMON017	g1945282	BLASTN	512	1e-33	84
1121	25399	701165922H1	SATMONN04	g1945282	BLASTN	569	1e-41	87
1122	25421	700018462H1	SATMON001	g945086	BLASTN	469	1e-30	74
1123	25421	700573169H1	SATMON030	g945086	BLASTN	894	1e-65	74
1124	25421	701164692H1	SATMONN04	g945087	BLASTN	132	1e-20	52
1125	25421	LIB189-007-Q1-E1-E6	LIB189	g945086	BLASTN	940	1e-69	72
1126	26277	LIB3061-020-Q1-K1-G7	LIB3061	g1945282	BLASTN	1139	1e-86	77
1127	26352	LIB143-011-Q1-E1-B7	LIB143	g1945280	BLASTN	731	1e-60	79
1128	26352	LIB3061-045-Q1-K1-A8	LIB3061	g1945280	BLASTN	930	1e-68	74
1129	26465	700100432H1	SATMON009	g2702280	BLASTN	172	1e-25	89
1130	26503	700443369H1	SATMON027	g2505876	BLASTN	80	1e-18	71
1131	26503	LIB3060-017-Q1-K1-C5	LIB3060	g2505876	BLASTN	213	1e-49	74
1132	26864	700204678H1	SATMON003	g2826884	BLASTN	176	1e-27	77
1133	26864	LIB3059-044-Q1-K1-F4	LIB3059	g1429226	BLASTN	203	1e-47	73
1134	27009	LIB83-013-Q1-E1-H1	LIB83	g2980802	BLASTN	152	1e-53	63
1135	27111	LIB3062-045-Q1-K1-B11	LIB3062	g945087	BLASTN	221	1e-48	87
1136	2728	700212033H1	SATMON016	g2245389	BLASTN	171	1e-09	80
1137	27567	LIB3067-002-Q1-K1-B10	LIB3067	g1905943	BLASTN	591	1e-39	92
1138	27567	LIB3067-049-Q1-K1-D7	LIB3067	g1905943	BLASTN	294	1e-29	79
1139	27660	LIB3069-033-Q1-K1-F11	LIB3069	g3183617	BLASTN	243	1e-51	84
1140	27677	700332676H1	SATMON019	g2463332	BLASTN	560	1e-37	90

1141	27677	LIB3069-009-Q1-K1-H3	LIB3069	g2463332	BLASTN	744	1e-51	77
1142	27677	LIB3069-020-Q1-K1-H6	LIB3069	g1914837	BLASTN	708	1e-48	77
1143	27687	700053756H1	SATMON011	g2104678	BLASTN	316	1e-26	70
1144	27687	LIB3078-050-Q1-K1-B6	LIB3078	g2104678	BLASTN	377	1e-42	65
1145	27707	700157026H1	SATMON012	g2062176	BLASTN	174	1e-25	60
1146	27707	LIB3078-054-Q1-K1-A12	LIB3078	g786425	BLASTN	384	1e-20	65
1147	27904	LIB148-063-Q1-E1-C7	LIB148	g1890351	BLASTN	511	1e-31	69
1148	27946	LIB143-017-Q1-E1-A1	LIB143	g2920839	BLASTN	424	1e-78	79
1149	28304	LIB3062-021-Q1-K1-F6	LIB3062	g939784	BLASTN	523	1e-36	83
1150	28304	LIB3067-031-Q1-K1-H5	LIB3067	g939784	BLASTN	321	1e-19	85
1151	28304	LIB3069-029-Q1-K1-H10	LIB3069	g939784	BLASTN	540	1e-36	84
1152	28366	LIB3062-015-Q1-K1-B9	LIB3062	g2642435	BLASTN	106	1e-38	66
1153	28408	700343287H1	SATMON021	g1905943	BLASTN	879	1e-64	95
1154	28408	LIB3067-049-Q1-K1-C2	LIB3067	g1905943	BLASTN	895	1e-65	94
1155	28408	LIB3068-037-Q1-K1-C1	LIB3068	g1905943	BLASTN	1025	1e-91	95
1156	28408	LIB3068-057-Q1-K1-F6	LIB3068	g1905943	BLASTN	977	1e-98	93
1157	28408	LIB3068-061-Q1-K1-D4	LIB3068	g1905943	BLASTN	1018	1e-93	92
1158	28420	700048913H1	SATMON003	g22379	BLASTN	540	1e-55	100
1159	28420	700208012H1	SATMON016	g22379	BLASTN	156	1e-16	99
1160	28420	LIB3061-023-Q1-K1-H1	LIB3061	g22379	BLASTN	604	1e-76	98
1161	28786	700342374H1	SATMON021	g1905943	BLASTN	942	1e-72	95
1162	28786	LIB3067-005-Q1-K1-A5	LIB3067	g1905943	BLASTN	1162	1e-115	95
1163	28786	LIB3067-029-Q1-K1-C1	LIB3067	g2286112	BLASTN	1578	1e-122	85
1164	28786	LIB3067-029-Q1-K1-D1	LIB3067	g2286112	BLASTN	1535	1e-119	85
1165	28786	LIB3068-043-Q1-K1-C7	LIB3068	g1905943	BLASTN	1082	1e-86	94
1166	28786	LIB3068-041-Q1-K1-B6	LIB3068	g1905943	BLASTN	1168	1e-99	90
1167	28804	700160819H1	SATMON012	g786426	BLASTN	143	1e-29	63
1168	28804	700169331H1	SATMON013	g786426	BLASTN	143	1e-26	78
1169	28804	700238677H1	SATMON010	g786426	BLASTN	132	1e-28	67
1170	28804	LIB3079-002-Q1-K1-E9	LIB3079	g786426	BLASTN	133	1e-44	67
1171	28804	LIB83-013-Q1-E1-E7	LIB83	g786426	BLASTN	143	1e-51	65
1172	289	700025965H1	SATMON003	g1666172	BLASTN	733	1e-52	74

1173	289	700074026H1	SATMON007	g1666172	BLASTN	730	1e-52	74
1174	289	700088568H1	SATMON011	g1666172	BLASTN	680	1e-48	74
1175	289	700102589H1	SATMON010	g1666172	BLASTN	670	1e-47	74
1176	289	700162412H1	SATMON012	g1666172	BLASTN	536	1e-36	71
1177	289	700163161H1	SATMON013	g1666173	BLASTN	116	1e-18	50
1178	289	700624536H1	SATMON034	g1666172	BLASTN	685	1e-48	72
1179	289	LIB143-009-Q1-E1-B4	LIB143	g1666172	BLASTN	663	1e-44	69
1180	289	LIB3059-020-Q1-K1-B12	LIB3059	g1666172	BLASTN	777	1e-56	74
1181	289	LIB3079-007-Q1-K1-B7	LIB3079	g1666172	BLASTN	795	1e-57	74
1182	289	LIB84-030-Q1-E1-A2	LIB84	g1666172	BLASTN	557	1e-54	72
1183	29009	LIB3059-049-Q1-K1-B3	LIB3059	g22380	BLASTN	142	1e-36	60
1184	29460	700475741H1	SATMON025	g2443887	BLASTN	153	1e-30	80
1185	2963	700241724H1	SATMON010	g1572786	BLASTN	84	1e-21	42
1186	2963	700242763H1	SATMON010	g1572786	BLASTN	86	1e-23	42
1187	29791	700171754H1	SATMON013	g1232131	BLASTN	517	1e-41	82
1188	30095	700104947H1	SATMON010	g1420923	BLASTN	242	1e-09	91
1189	30254	701178677H1	SATMONN05	g1707639	BLASTN	494	1e-62	83
1190	30254	LIB3079-021-Q1-K1-D7	LIB3079	g1707639	BLASTN	672	1e-94	80
1191	31077	LIB3067-005-Q1-K1-F7	LIB3067	g939784	BLASTN	221	1e-21	98
1192	31077	LIB3067-049-Q1-K1-C4	LIB3067	g939784	BLASTN	265	1e-24	95
1193	31174	700282073H1	SATMON022	g1199574	BLASTN	398	1e-22	61
1194	31174	LIB3067-046-Q1-K1-E10	LIB3067	g1049022	BLASTN	150	1e-58	49
1195	31174	LIB3069-051-Q1-K1-B3	LIB3069	g2979566	BLASTN	234	1e-57	48
1196	31175	700553186H1	SATMON022	g886400	BLASTN	669	1e-68	88
1197	31175	LIB3067-010-Q1-K1-G12	LIB3067	g886400	BLASTN	905	1e-104	82
1198	313	700030176H1	SATMON003	g2982330	BLASTN	727	1e-56	79
1199	313	700089309H1	SATMON011	g290056	BLASTN	683	1e-48	73
1200	313	700160174H1	SATMON012	g290056	BLASTN	672	1e-47	75
1201	313	700160389H1	SATMON012	g290056	BLASTN	695	1e-49	78
1202	313	700193966H1	SATMON014	g2982330	BLASTN	459	1e-32	87
1203	313	700198034H1	SATMON016	g290056	BLASTN	690	1e-48	78
1204	313	700223702H1	SATMON011	g1353667	BLASTN	195	1e-28	76
1205	313	700256992H1	SATMON017	g2982331	BLASTN	114	1e-31	95
1206	313	700334428H1	SATMON019	g290057	BLASTN	215	1e-44	69
1207	313	700345766H1	SATMON021	g2982330	BLASTN	573	1e-39	79
1208	313	700428724H1	SATMONN01	g2982330	BLASTN	840	1e-61	79
1209	313	700438829H1	SATMON026	g290056	BLASTN	331	1e-33	75
1210	313	700438866H1	SATMON026	g290056	BLASTN	681	1e-47	73
1211	313	700455822H1	SATMON029	g2982330	BLASTN	782	1e-56	79
1212	313	700456156H1	SATMON029	g2982330	BLASTN	804	1e-58	79
1213	313	700457422H1	SATMON029	g2982330	BLASTN	793	1e-57	78
1214	313	700464587H1	SATMON025	g290056	BLASTN	572	1e-38	76
1215	313	700472413H1	SATMON025	g2982330	BLASTN	893	1e-65	78

1216	313	700549413H1	SATMON022	g2982330	BLASTN	825	1e-60	79
1217	313	700549675H1	SATMON022	g290056	BLASTN	426	1e-51	76
1218	313	700550305H1	SATMON022	g2982330	BLASTN	863	1e-63	79
1219	313	700576902H1	SATMON031	g290057	BLASTN	139	1e-28	83
1220	313	700582445H1	SATMON031	g2982330	BLASTN	465	1e-29	80
1221	313	700614836H1	SATMON033	g290056	BLASTN	399	1e-24	78
1222	313	LIB148-052-Q1-E1-A5	LIB148	g290056	BLASTN	795	1e-58	74
1223	313	LIB189-019-Q1-E1-G7	LIB189	g290056	BLASTN	645	1e-89	74
1224	313	LIB3059-003-Q1-K1-C10	LIB3059	g290056	BLASTN	1165	1e-88	74
1225	313	LIB3059-040-Q1-K1-F9	LIB3059	g290056	BLASTN	1252	1e-95	75
1226	313	LIB3061-034-Q1-K1-B7	LIB3061	g290056	BLASTN	924	1e-68	75
1227	313	LIB3062-039-Q1-K1-F1	LIB3062	g2982330	BLASTN	1207	1e-105	79
1228	313	LIB3069-006-Q1-K1-F8	LIB3069	g290056	BLASTN	756	1e-54	74
1229	313	LIB3079-014-Q1-K1-H12	LIB3079	g290056	BLASTN	967	1e-71	71
1230	313	LIB83-008-Q1-E1-E4	LIB83	g290056	BLASTN	834	1e-78	73
1231	3191	700098953H1	SATMON009	g2735839	BLASTN	283	1e-12	69
1232	31934	700350370H1	SATMON023	g508577	BLASTN	81	1e-20	49
1233	31934	LIB3069-033-Q1-K1-G4	LIB3069	g508576	BLASTN	658	1e-49	73
1234	31938	LIB3068-005-Q1-K1-D12	LIB3068	g218339	BLASTN	304	1e-26	76
1235	31938	LIB3068-044-Q1-K1-G10	LIB3068	g218339	BLASTN	571	1e-75	73
1236	31977	LIB3062-018-Q1-K1-B10	LIB3062	g2464855	BLASTN	250	1e-70	74
1237	31977	LIB3069-031-Q1-K1-G7	LIB3069	g1263095	BLASTN	117	1e-43	73
1238	32236	LIB3060-007-Q1-K1-F7	LIB3060	g2653353	BLASTN	56	1e-33	37
1239	32402	LIB3059-037-Q1-K1-A3	LIB3059	g1905929	BLASTN	899	1e-98	82
1240	32402	LIB3067-032-Q1-K1-C5	LIB3067	g2463332	BLASTN	1035	1e-77	84
1241	32442	LIB3060-041-Q1-K1-C5	LIB3060	g2911067	BLASTN	503	1e-87	69
1242	32675	LIB143-003-Q1-E1-E5	LIB143	g2062176	BLASTN	228	1e-49	62
1243	32760	700343406H1	SATMON021	g1905943	BLASTN	454	1e-63	95
1244	32760	LIB189-029-Q1-E1-D2	LIB189	g1905943	BLASTN	912	1e-80	91
1245	3309	700092223H1	SATMON008	g2826884	BLASTN	92	1e-21	58
1246	3309	700334938H1	SATMON019	g2149996	BLASTN	120	1e-18	43
1247	339	700624240H1	SATMON034	g551535	BLASTN	89	1e-22	47
1248	339	701185145H1	SATMONN06	g1616942	BLASTN	90	1e-19	56
1249	3641	700102125H1	SATMON010	g2088643	BLASTN	278	1e-42	68

Table 1	
Summary of the results of the 1990-1991 survey	
Number of respondents	100
Male	74
Female	26
Age (years)	
18-24	10
25-34	30
35-44	20
45-54	10
55-64	10
65+	10
Education (years)	
0-8	10
9-11	30
12-14	20
15-17	10
18-20	10
21+	10
Occupation	
Unemployed	10
Student	10
Homemaker	10
Professional	10
Managerial	10
Technical	10
Skilled	10
Unskilled	10
Other	10
Marital status	
Single	10
Married	10
Divorced	10
Widowed	10
Other	10
Religion	
Christian	10
Muslim	10
Hindu	10
Buddhist	10
Other	10
Language	
English	10
Malay	10
Tamil	10
Other	10
Region	
North	10
Central	10
South	10
Other	10

		Q1-K1-H5						
1296	4573	LIB3068-033-Q1-K1-H9	LIB3068	g556559	BLASTN	1610	1e-141	88
1297	4573	LIB3068-033-Q1-K1-H10	LIB3068	g556559	BLASTN	1168	1e-88	83
1298	4573	LIB3078-018-Q1-K1-H2	LIB3078	g556559	BLASTN	1569	1e-122	83
1299	4675	700343053H1	SATMON021	g2735839	BLASTN	917	1e-99	94
1300	4675	700347336H1	SATMON021	g2735839	BLASTN	750	1e-73	90
1301	4675	700451244H1	SATMON028	g2735839	BLASTN	426	1e-55	92
1302	4726	700042529H1	SATMON004	g1429227	BLASTN	388	1e-43	77
1303	4726	700094180H1	SATMON008	g1429228	BLASTN	112	1e-18	85
1304	4726	700153844H1	SATMON007	g2826882	BLASTN	200	1e-31	95
1305	4726	700154748H1	SATMON007	g2826881	BLASTN	494	1e-32	78
1306	4726	700167910H1	SATMON013	g2826882	BLASTN	162	1e-26	94
1307	4726	700238147H1	SATMON010	g2826882	BLASTN	187	1e-29	75
1308	4726	700243593H1	SATMON010	g2826881	BLASTN	509	1e-33	79
1309	4726	700266003H1	SATMON017	g2826881	BLASTN	604	1e-41	82
ERR	4726		SATMONN01	CLUSTER				
OR								
1310	4726	700618813H1	SATMON034	g2826881	BLASTN	569	1e-38	78
1311	4726	LIB143-031-Q1-E1-B4	LIB143	g2826881	BLASTN	601	1e-39	71
1312	4726	LIB3067-037-Q1-K1-G10	LIB3067	g2826881	BLASTN	592	1e-38	76
1313	4726	LIB3067-057-Q1-K1-A8	LIB3067	g2826881	BLASTN	724	1e-50	78
1314	4726	LIB3078-033-Q1-K1-C11	LIB3078	g2826881	BLASTN	848	1e-62	77
1315	4825	700342288H1	SATMON021	g2463332	BLASTN	316	1e-31	78
1316	4825	700347334H1	SATMON021	g2463332	BLASTN	439	1e-47	74
1317	4825	LIB3067-030-Q1-K1-E9	LIB3067	g2286110	BLASTN	333	1e-38	78
1318	4837	700091432H1	SATMON011	g2160167	BLASTN	241	1e-34	42
1319	4837	700342234H1	SATMON021	g1747310	BLASTN	194	1e-28	44
1320	4837	LIB143-058-Q1-E1-G4	LIB143	g2160167	BLASTN	207	1e-46	39
1321	5120	700091876H1	SATMON011	g2982330	BLASTN	668	1e-47	78
1322	5120	700445847H1	SATMON027	g2982330	BLASTN	466	1e-44	79
1323	5120	700445848H1	SATMON027	g2982330	BLASTN	470	1e-44	77
1324	5120	700614010H1	SATMON033	g2982330	BLASTN	489	1e-30	77
1325	5182	700093349H1	SATMON008	g2104681	BLASTN	166	1e-26	73
1326	5182	700167439H1	SATMON013	g2104681	BLASTN	160	1e-23	78
1327	5182	700265385H1	SATMON017	g2104681	BLASTN	166	1e-24	76
1328	5468	700082261H1	SATMON011	g2735764	BLASTN	116	1e-17	32
1329	5468	700172754H1	SATMON013	g2735764	BLASTN	148	1e-22	48
1330	6098	700023212H1	SATMON003	g556557	BLASTN	1032	1e-77	87
1331	6098	700026534H1	SATMON003	g556557	BLASTN	1035	1e-77	84
1332	6098	700050928H1	SATMON003	g556557	BLASTN	818	1e-59	87
1333	6098	700082788H1	SATMON011	g556557	BLASTN	1250	1e-95	88
1334	6098	700151293H1	SATMON007	g556557	BLASTN	672	1e-47	89
1335	6098	700156895H1	SATMON012	g556557	BLASTN	997	1e-74	89
1336	6098	700160036H1	SATMON012	g556557	BLASTN	978	1e-72	87
1337	6098	700169134H1	SATMON013	g556557	BLASTN	895	1e-65	87

1338	6098	700196770H1	SATMON014	g556558	BLASTN	135	1e-20	100
1339	6098	700204094H1	SATMON003	g556557	BLASTN	418	1e-26	79
1340	6098	700207890H1	SATMON016	g556557	BLASTN	1196	1e-90	88
1341	6098	700209368H1	SATMON016	g556557	BLASTN	1080	1e-89	86
1342	6098	700216846H1	SATMON016	g556557	BLASTN	984	1e-73	84
1343	6098	700217125H1	SATMON016	g556557	BLASTN	911	1e-67	84
1344	6098	700335980H1	SATMON019	g556557	BLASTN	554	1e-37	86
1345	6098	700350881H1	SATMON023	g556557	BLASTN	699	1e-73	82
1346	6098	700379915H1	SATMON021	g556557	BLASTN	1117	1e-84	86
1347	6098	700405447H1	SATMON029	g556557	BLASTN	515	1e-34	91
1348	6098	700423625H1	SATMONN01	g556557	BLASTN	942	1e-69	84
1349	6098	700445715H1	SATMON027	g556557	BLASTN	1107	1e-83	87
1350	6098	700576616H1	SATMON030	g556557	BLASTN	710	1e-50	84
1351	6098	700581258H1	SATMON031	g556557	BLASTN	757	1e-69	83
1352	6098	700621691H1	SATMON034	g556557	BLASTN	955	1e-97	87
1353	6098	700622003H1	SATMON034	g556557	BLASTN	302	1e-14	90
1354	6098	701183623H1	SATMONN06	g556557	BLASTN	956	1e-70	84
1355	6098	701183722H1	SATMONN06	g556557	BLASTN	568	1e-38	70
1356	6098	LIB3059-047-Q1-K1-C2	LIB3059	g556557	BLASTN	998	1e-114	87
1357	6098	LIB3069-022-Q1-K1-B3	LIB3069	g556557	BLASTN	1458	1e-112	83
1358	6098	LIB3078-029-Q1-K1-B7	LIB3078	g556557	BLASTN	990	1e-73	84
1359	6196	700102457H1	SATMON010	g556559	BLASTN	1239	1e-94	86
1360	6196	700154733H1	SATMON007	g556559	BLASTN	779	1e-59	86
1361	6196	700161033H1	SATMON012	g556559	BLASTN	866	1e-63	86
1362	6196	700163235H1	SATMON013	g556559	BLASTN	912	1e-67	85
1363	6196	700552020H1	SATMON022	g556559	BLASTN	1065	1e-79	85
1364	6196	LIB3062-021-Q1-K1-G12	LIB3062	g556559	BLASTN	1113	1e-83	85
1365	6196	LIB3069-042-Q1-K1-C9	LIB3069	g556559	BLASTN	1264	1e-106	85
1366	6422	700048971H1	SATMON003	g2735766	BLASTN	198	1e-31	75
1367	6422	700049939H1	SATMON003	g2286110	BLASTN	444	1e-26	74
1368	6422	700163770H1	SATMON013	g2735766	BLASTN	116	1e-18	79
1369	6422	700166354H1	SATMON013	g431908	BLASTN	203	1e-30	64
1370	6422	700169344H1	SATMON013	g508576	BLASTN	191	1e-11	79
1371	6422	700471581H1	SATMON025	g2735764	BLASTN	142	1e-27	75
1372	6508	700030014H1	SATMON003	g2160167	BLASTN	255	1e-36	48
1373	6508	700087039H1	SATMON011	g2160167	BLASTN	268	1e-38	50
1374	6508	701180711H1	SATMONN06	g1747310	BLASTN	194	1e-32	62
1375	7120	700805333H1	SATMON036	g309569	BLASTN	181	1e-10	95
1376	7914	700553220H1	SATMON022	g1239960	BLASTN	263	1e-11	64
1377	7914	700553228H1	SATMON022	g1239960	BLASTN	446	1e-26	69
1378	7914	LIB3067-006-Q1-K1-B4	LIB3067	g939784	BLASTN	537	1e-33	62
1379	7914	LIB3067-018-Q1-K1-F7	LIB3067	g939784	BLASTN	518	1e-32	62
1380	7971	700053716H1	SATMON011	g556559	BLASTN	742	1e-53	84

1430	-700165751	700165751H1	SATMON013	g22330	BLASTN	910	1e-66	100
1431	-700168414	700168414H1	SATMON013	g22350	BLASTN	1158	1e-87	91
1432	-700171978	700171978H1	SATMON013	g1648930	BLASTN	885	1e-64	100
1433	-700172688	700172688H1	SATMON013	g1143704	BLASTN	1142	1e-86	98
1434	-700173028	700173028H1	SATMON013	g1008878	BLASTN	313	1e-42	93
1435	-700202132	700202132H1	SATMON003	g2244990	BLASTN	171	1e-25	82
1436	-700210656	700210656H1	SATMON016	g349379	BLASTN	118	1e-28	82
1437	-700215409	700215409H1	SATMON016	g1648930	BLASTN	1484	1e-114	98
1438	-700215454	700215454H1	SATMON016	g1045043	BLASTN	491	1e-32	67
1439	-700218764	700218764H1	SATMON011	g1143706	BLASTN	781	1e-56	97
1440	-700219170	700219170H1	SATMON011	g2464893	BLASTN	377	1e-54	94
1441	-700219660	700219660H1	SATMON011	g1173621	BLASTN	323	1e-40	76
1442	-700219669	700219669H1	SATMON011	g1173622	BLASTN	281	1e-40	72
1443	-700221310	700221310H1	SATMON011	g507220	BLASTN	233	1e-33	46
1444	-700223225	700223225H1	SATMON011	g1143706	BLASTN	1290	1e-98	100
1445	-700241610	700241610H1	SATMON010	g22330	BLASTN	294	1e-35	93
1446	-700244303	700244303H1	SATMON010	g22330	BLASTN	557	1e-43	99
1447	-700261794	700261794H1	SATMON017	g2935572	BLASTN	448	1e-42	82
1448	-700263117	700263117H1	SATMON017	g1045044	BLASTN	169	1e-25	81
1449	-700265365	700265365H1	SATMON017	g499164	BLASTN	223	1e-38	67
1450	-700349657	700349657H1	SATMON023	g1143706	BLASTN	1106	1e-83	88
1451	-700351961	700351961H1	SATMON023	g2522483	BLASTN	246	1e-12	76
1452	-700355847	700355847H1	SATMON024	g1173621	BLASTN	862	1e-62	76
1453	-700378702	700378702H1	SATMON020	g1648930	BLASTN	626	1e-99	97
1454	-700379506	700379506H1	SATMON020	g1648930	BLASTN	268	1e-12	98
1455	-700379734	700379734H1	SATMON021	g1173622	BLASTN	129	1e-19	47
1456	-700421514	700421514H1	SATMONN01	g22330	BLASTN	193	1e-09	82
1457	-700432368	700432368H1	SATMONN01	g1122533	BLASTN	76	1e-18	65
1458	-700439251	700439251H1	SATMON026	g2529702	BLASTN	391	1e-28	71
1459	-700447203	700447203H1	SATMON027	g2464893	BLASTN	123	1e-18	51
1460	-700467939	700467939H1	SATMON025	g452519	BLASTN	160	1e-24	47
1461	-700471940	700471940H1	SATMON025	g1814424	BLASTN	123	1e-33	54
1462	-700474077	700474077H1	SATMON025	g1143704	BLASTN	270	1e-13	81
1463	-700552169	700552169H1	SATMON022	g2464893	BLASTN	171	1e-25	39
1464	-700552223	700552223H1	SATMON022	g1008878	BLASTN	530	1e-71	85
1465	-700571166	700571166H1	SATMON030	g166754	BLASTN	95	1e-20	87
1466	-700574329	700574329H2	SATMON030	g2244990	BLASTN	220	1e-35	57
1467	-700574833	700574833H1	SATMON030	g1143706	BLASTN	1075	1e-132	100
1468	-700581639	700581639H1	SATMON031	g22330	BLASTN	168	1e-11	93
1469	-700611333	700611333H1	SATMON022	g507220	BLASTN	153	1e-23	46
1470	-700615009	700615009H1	SATMON033	g2244990	BLASTN	190	1e-44	82
1471	-700617943	700617943H1	S					

1484	12817	700093049H1	SATMON008	g1143704	BLASTN	817	1e-59	98
1485	12817	700552210H1	SATMON022	g1143704	BLASTN	1174	1e-88	97
1486	12817	700553281H1	SATMON022	g1143704	BLASTN	266	1e-13	98
1487	12817	700574165H1	SATMON030	g1143704	BLASTN	836	1e-71	95
1488	13037	700073709H1	SATMON007	g1008878	BLASTN	944	1e-69	87
1489	13037	700282113H1	SATMON022	g1008878	BLASTN	576	1e-66	95
1490	13120	700263311H1	SATMON017	g2388574	BLASTN	91	1e-25	62
1491	13120	700267466H1	SATMON017	g1173622	BLASTN	70	1e-23	68
1492	1402	700048947H1	SATMON003	g2529702	BLASTN	496	1e-38	75
1493	1402	700074563H1	SATMON007	g2738464	BLASTN	104	1e-17	79
1494	1402	700450537H1	SATMON028	g2529702	BLASTN	475	1e-30	77
1495	1402	700617584H1	SATMON033	g2529702	BLASTN	442	1e-26	80
1496	1402	700621952H1	SATMON034	g2529702	BLASTN	418	1e-28	75
1497	14385	700085542H1	SATMON011	g2244990	BLASTN	139	1e-44	81
1498	15611	700215778H1	SATMON016	g309573	BLASTN	475	1e-30	77
1499	16940	700085254H1	SATMON011	g1008879	BLASTN	179	1e-32	59
1500	16940	700087804H1	SATMON011	g1008879	BLASTN	179	1e-26	70
1501	17209	700156405H1	SATMON012	g2244990	BLASTN	113	1e-17	80
1502	17209	700614092H1	SATMON033	g2244990	BLASTN	138	1e-21	71
1503	1831	700216393H1	SATMON016	g22330	BLASTN	412	1e-24	97
1504	19924	700090084H1	SATMON011	g2244990	BLASTN	208	1e-30	100
1505	19976	LIB3062-028-Q1-K1-G3	LIB3062	g549891	BLASTN	175	1e-49	55
1506	19976	LIB3067-036-Q1-K1-B12	LIB3067	g1435022	BLASTN	155	1e-39	68
1507	20055	700090163H1	SATMON011	g1814424	BLASTN	126	1e-24	52
1508	20560	700611944H1	SATMON022	g1008878	BLASTN	338	1e-17	72
1509	20560	700611959H1	SATMON022	g2522483	BLASTN	308	1e-20	77
1510	20838	700571750H1	SATMON030	g22330	BLASTN	1072	1e-95	96
1511	20838	700575750H1	SATMON030	g22330	BLASTN	949	1e-70	90
1512	21483	LIB3062-043-Q1-K1-E7	LIB3062	g349267	BLASTN	82	1e-44	63
1513	21642	700552148H1	SATMON022	g2935572	BLASTN	854	1e-72	85
1514	21642	700582548H1	SATMON031	g2935572	BLASTN	844	1e-72	84
1515	21719	700169585H1	SATMON013	g1143706	BLASTN	1146	1e-86	99
1516	21719	700469049H1	SATMON025	g1143706	BLASTN	1432	1e-110	98
1517	22019	700027141H1	SATMON003	g1045041	BLASTN	565	1e-54	75
1518	22019	700163580H1	SATMON013	g1946222	BLASTN	120	1e-27	62
1519	22019	LIB3078-024-Q1-K1-D11	LIB3078	g3116211	BLASTN	534	1e-50	79
1520	2277	700457038H1	SATMON029	g349266	BLASTN	429	1e-26	68
1521	2277	700457044H1	SATMON029	g349266	BLASTN	284	1e-30	72
1522	2277	LIB3078-027-Q1-K1-D7	LIB3078	g349266	BLASTN	489	1e-31	71
1523	23635	701186070H1	SATMONN06	g16334	BLASTN	116	1e-26	72
1524	23635	LIB143-059-Q1-E1-D6	LIB143	g349266	BLASTN	579	1e-39	75
1525	23635	LIB3059-040-Q1-K1-B1	LIB3059	g166754	BLASTN	234	1e-52	64
1526	23983	LIB3060-001-Q1-K2-A2	LIB3060	g499164	BLASTN	81	1e-33	74
1527	23983	LIB3060-002-Q1-K2-G9	LIB3060	g499163	BLASTN	501	1e-30	66
1528	23983	LIB3060-002-	LIB3060	g499163	BLASTN	443	1e-25	71

Q1-K2-G10								
1529	25703	700094029H1	SATMON008	g1143706	BLASTN	730	1e-93	94
1530	25703	701161267H1	SATMONN04	g1143706	BLASTN	620	1e-42	95
1531	26329	700102662H1	SATMON010	g1143704	BLASTN	1670	1e-130	100
1532	26329	700222436H1	SATMON011	g1143706	BLASTN	1203	1e-91	99
1533	26329	700240490H1	SATMON010	g1143704	BLASTN	1396	1e-107	99
1534	26329	LIB3069-017-	LIB3069	g1143704	BLASTN	1653	1e-149	97
Q1-K1-C7								
1535	26972	700261630H1	SATMON017	g1814424	BLASTN	266	1e-38	75
1536	26972	LIB84-004-	LIB84	g1173621	BLASTN	564	1e-36	66
Q1-E1-G12								
1537	28499	700022091H1	SATMON001	g22350	BLASTN	966	1e-71	98
1538	28499	LIB3067-044-	LIB3067	g22350	BLASTN	980	1e-76	95
Q1-K1-G8								
1539	32276	700467151H1	SATMON025	g2244990	BLASTN	123	1e-36	71
1540	32758	LIB189-021-	LIB189	g1881536	BLASTN	142	1e-37	62
Q1-E1-B1								
1541	3792	700207835H1	SATMON016	g1814424	BLASTN	264	1e-40	74
1542	3792	700474795H1	SATMON025	g1173622	BLASTN	102	1e-24	60
1543	5147	700049946H1	SATMON003	g2464893	BLASTN	233	1e-34	76
1544	5147	700089031H1	SATMON011	g2464893	BLASTN	306	1e-48	71
1545	5147	700089032H1	SATMON011	g1122533	BLASTN	215	1e-34	61
1546	6534	700073312H1	SATMON007	g1122532	BLASTN	440	1e-26	66
1547	6534	700377243H1	SATMON019	g2464893	BLASTN	226	1e-38	77
1548	7480	700071941H1	SATMON007	g1143704	BLASTN	1450	1e-115	98
1549	7480	700281684H1	SATMON020	g1143704	BLASTN	1365	1e-104	100
1550	7480	700548984H1	SATMON022	g1143704	BLASTN	1320	1e-102	97
1551	7480	700576352H1	SATMON030	g1143704	BLASTN	523	1e-71	94
1552	7480	700581679H1	SATMON031	g1143704	BLASTN	766	1e-73	99
1553	7480	700616428H1	SATMON033	g1143704	BLASTN	690	1e-87	92
1554	8104	700441126H1	SATMON026	g2464893	BLASTN	225	1e-33	52
1555	8104	700444259H1	SATMON027	g2464893	BLASTN	115	1e-17	54

MAIZE LEUCINE ZIPPER TRANSCRIPTION FACTOR

Seq No.	Cluster ID	CloneID	Library	NCBI gi	METHOD	Score	P-Value	%Ident
1556	-700026759	700026759H1	SATMON003	g2317905	BLASTN	101	1e-20	38
1557	-700043856	700043856H1	SATMON004	g1052959	BLASTN	236	1e-08	84
1558	-700045214	700045214H1	SATMON004	g1052959	BLASTN	344	1e-18	76
1559	-700051334	700051334H1	SATMON003	g21635	BLASTN	89	1e-20	80
1560	-700052422	700052422H1	SATMON003	g414613	BLASTN	141	1e-26	73
1561	-700073288	700073288H1	SATMON007	g2253277	BLASTN	185	1e-08	82
1562	-700076538	700076538H1	SATMON007	g2291143	BLASTN	138	1e-23	39
1563	-700082003	700082003H1	SATMON011	g790575	BLASTN	123	1e-18	53
1564	-700085627	700085627H1	SATMON011	g394735	BLASTN	261	1e-10	63
1565	-700086363	700086363H1	SATMON011	g2651296	BLASTN	134	1e-20	36
1566	-700088669	700088669H1	SATMON011	g2281449	BLASTN	100	1e-22	74
1567	-700090111	700090111H1	SATMON011	g16429	BLASTN	123	1e-21	60
1568	-700100046	700100046H1	SATMON009	g19275	BLASTN	215	1e-31	39
1569	-700101881	700101881H1	SATMON009	g19275	BLASTN	189	1e-28	42
1570	-700103640	700103640H1	SATMON010	g2921823	BLASTN	124	1e-19	74
1571	-700104159	700104159H1	SATMON010	g2865393	BLASTN	293	1e-13	75
1572	-700151219	700151219H1	SATMON007	g2317905	BLASTN	125	1e-19	53

1573	-700154149	700154149H1	SATMON007	g435941	BLASTN	240	1e-11	87
1574	-700154895	700154895H1	SATMON007	g19275	BLASTN	139	1e-21	38
1575	-700172865	700172865H1	SATMON013	g2253277	BLASTN	670	1e-47	76
1576	-700195674	700195674H1	SATMON014	g21634	BLASTN	428	1e-25	81
1577	-700197522	700197522H1	SATMON014	g19275	BLASTN	174	1e-25	56
1578	-700208483	700208483H1	SATMON016	g19275	BLASTN	104	1e-25	36
1579	-700211494	700211494H1	SATMON016	g435941	BLASTN	564	1e-38	84
1580	-700216833	700216833H1	SATMON016	g19275	BLASTN	101	1e-19	39
1581	-700221766	700221766H1	SATMON011	g2253278	BLASTN	150	1e-22	74
1582	-700224641	700224641H1	SATMON011	g2317905	BLASTN	109	1e-22	41
1583	-700224775	700224775H1	SATMON011	g600855	BLASTN	115	1e-17	39
1584	-700237947	700237947H1	SATMON010	g19275	BLASTN	172	1e-25	54
1585	-700238972	700238972H1	SATMON010	g21634	BLASTN	517	1e-60	80
1586	-700263988	700263988H1	SATMON017	g2253278	BLASTN	133	1e-20	38
1587	-700265544	700265544H1	SATMON017	g19275	BLASTN	74	1e-19	40
1588	-700337561	700337561H1	SATMON020	g21634	BLASTN	228	1e-13	83
335	-700341946	700341946H1	SATMON020	g2104677	BLASTN	97	1e-28	60
1589	-700349755	700349755H1	SATMON023	g435941	BLASTN	450	1e-47	82
1590	-700447061	700447061H1	SATMON027	g435941	BLASTN	436	1e-63	89
1591	-700448554	700448554H1	SATMON028	g292447	BLASTN	102	1e-27	66
1592	-700474347	700474347H1	SATMON025	g1147631	BLASTN	477	1e-39	79
1593	-700617187	700617187H1	SATMON033	g1147631	BLASTN	403	1e-24	81
1594	-700621840	700621840H1	SATMON034	g2246376	BLASTN	96	1e-25	67
1595	-700803395	700803395H1	SATMON036	g22383	BLASTN	311	1e-33	98
1596	-700803857	700803857H1	SATMON036	g22383	BLASTN	539	1e-61	96
1597	-700804349	700804349H1	SATMON036	g22383	BLASTN	276	1e-31	90
1598	-701167790	701167790H1	SATMONN05	g2865393	BLASTN	768	1e-55	77
1599	-701168742	701168742H1	SATMONN05	g2865393	BLASTN	488	1e-31	68
1600	-701173087	701173087H2	SATMONN05	g2281448	BLASTN	356	1e-18	74
1475	-701178369	701178369H1	SATMONN05	g1235564	BLASTN	331	1e-16	73
1601	-701181780	701181780H1	SATMONN06	g1783305	BLASTN	126	1e-19	55
1602	10022	LIB3078-012-Q1-K1-H4	LIB3078	g2959559	BLASTN	93	1e-37	46
1603	10491	700095022H1	SATMON008	g2921822	BLASTN	744	1e-53	72
1604	10491	700205717H1	SATMON003	g2921822	BLASTN	693	1e-48	73
1605	10491	700258018H1	SATMON017	g2921822	BLASTN	683	1e-48	73
1606	11184	700026566H1	SATMON003	g19275	BLASTN	136	1e-23	36
1607	11184	700167820H1	SATMON013	g19275	BLASTN	136	1e-21	36
1608	11184	700170288H1	SATMON013	g19275	BLASTN	130	1e-19	33
1609	11184	LIB3059-023-Q1-K1-E11	LIB3059	g19275	BLASTN	146	1e-40	40
1610	11184	LIB3066-021-Q1-K1-H6	LIB3066	g19275	BLASTN	171	1e-57	43
1611	12153	700461111H1	SATMON033	g600855	BLASTN	156	1e-23	39
1612	12866	700551880H1	SATMON022	g435941	BLASTN	337	1e-43	80
1613	12866	700579217H1	SATMON031	g435941	BLASTN	635	1e-71	88
1614	13159	700381959H1	SATMON023	g2253278	BLASTN	93	1e-19	83
1615	13855	700092464H1	SATMON008	g2564278	BLASTN	115	1e-17	24
1616	14112	700082712H1	SATMON011	g600855	BLASTN	159	1e-23	34
1617	14112	700088489H1	SATMON011	g600855	BLASTN	168	1e-25	39
1618	15173	700577567H1	SATMON031	g435941	BLASTN	609	1e-41	84
1619	15173	700622606H1	SATMON034	g435941	BLASTN	411	1e-35	82
1620	15365	700569809H1	SATMON030	g19275	BLASTN	294	1e-47	52
1621	15877	700577006H1	SATMON031	g1033195	BLASTN	124	1e-19	88

1622	16241	LIB3062-019-Q1-K1-G1	LIB3062	g19275	BLASTN	142	1e-47	35
1623	17029	700099008H1	SATMON009	g1060934	BLASTN	237	1e-10	94
1624	17029	700102025H1	SATMON010	g1060934	BLASTN	698	1e-75	85
1625	17029	700165819H1	SATMON013	g1060934	BLASTN	550	1e-37	91
1626	17029	700168474H1	SATMON013	g1060934	BLASTN	443	1e-28	86
1627	17029	700171701H1	SATMON013	g1060934	BLASTN	781	1e-56	88
1628	17029	LIB143-011-Q1-E1-H5	LIB143	g1060934	BLASTN	1165	1e-107	96
1629	17029	LIB3060-006-Q1-K1-C10	LIB3060	g1060934	BLASTN	1316	1e-123	87
1630	17029	LIB3060-046-Q1-K1-B2	LIB3060	g1060934	BLASTN	1522	1e-145	91
1631	17891	700018093H1	SATMON001	g19275	BLASTN	118	1e-23	69
1632	17891	700550775H1	SATMON022	g19275	BLASTN	152	1e-35	64
1633	17891	LIB143-027-Q1-E1-C10	LIB143	g19275	BLASTN	109	1e-34	73
1634	18790	700083176H1	SATMON011	g19275	BLASTN	245	1e-35	44
1635	18790	700218787H1	SATMON011	g19275	BLASTN	188	1e-27	40
1506	19976	LIB3067-036-Q1-K1-B12	LIB3067	g1435022	BLASTN	155	1e-39	68
1636	20163	LIB3061-037-Q1-K1-G8	LIB3061	g22383	BLASTN	449	1e-104	86
1637	20233	700084065H1	SATMON011	g1060934	BLASTN	1396	1e-107	99
1638	20233	700167866H1	SATMON013	g1060934	BLASTN	1040	1e-77	100
1639	20233	701168486H1	SATMONN05	g1060934	BLASTN	996	1e-74	99
1640	20966	700153842H1	SATMON007	g600854	BLASTN	562	1e-38	72
1641	20966	701159849H1	SATMONN04	g600855	BLASTN	178	1e-39	72
1642	20966	701181355H1	SATMONN06	g600855	BLASTN	182	1e-36	63
1643	2233	700044102H1	SATMON004	g1033194	BLASTN	951	1e-70	84
1644	2233	700045607H1	SATMON004	g1033194	BLASTN	986	1e-73	82
1645	2233	700046019H1	SATMON004	g1052959	BLASTN	810	1e-58	76
1646	2233	700097636H1	SATMON009	g1052959	BLASTN	726	1e-77	80
1647	2233	700098421H1	SATMON009	g1052959	BLASTN	492	1e-46	78
1648	2233	700167584H1	SATMON013	g1052959	BLASTN	742	1e-53	81
1649	2233	700214820H1	SATMON016	g1052959	BLASTN	720	1e-51	80
1650	2233	700215075H1	SATMON016	g1052959	BLASTN	783	1e-56	76
1651	2233	700217212H1	SATMON016	g1052960	BLASTN	246	1e-36	82
1652	2233	700422645H1	SATMONN01	g1052959	BLASTN	454	1e-29	72
1653	2233	700423383H1	SATMONN01	g1052960	BLASTN	102	1e-33	91
1654	2233	700424963H1	SATMONN01	g1052959	BLASTN	506	1e-33	79
1655	2233	700425938H1	SATMONN01	g1052960	BLASTN	134	1e-20	81
1656	2233	700426188H1	SATMONN01	g1052960	BLASTN	178	1e-26	68
1657	2233	700430714H1	SATMONN01	g1052959	BLASTN	617	1e-42	79
1658	2233	700438641H1	SATMON026	g1033194	BLASTN	594	1e-40	81
1659	2233	700439768H1	SATMON026	g1033194	BLASTN	385	1e-28	81
1660	2233	700460877H1	SATMON031	g1052960	BLASTN	108	1e-18	87
1661	2233	700578130H1	SATMON031	g1033194	BLASTN	469	1e-29	64
1662	2233	700582130H1	SATMON031	g1052959	BLASTN	682	1e-48	73
1663	2233	LIB189-002-Q1-E1-C1	LIB189	g1033194	BLASTN	1393	1e-107	82
1664	2233	LIB3060-008-Q1-K1-A3	LIB3060	g1033194	BLASTN	761	1e-52	78
1665	2233	LIB3067-039-	LIB3067	g1033194	BLASTN	1448	1e-111	81

1666	2233	Q1-K1-G12 LIB3068-043-	LIB3068	g1033194	BLASTN	962	1e-82	76
1667	2233	Q1-K1-G9 LIB36-010-	LIB36	g1052959	BLASTN	1210	1e-92	79
1668	2233	Q1-E1-D5 LIB84-027-	LIB84	g1052959	BLASTN	1013	1e-87	80
1669	22540	Q1-E1-E12 700352565H1	SATMON023	g1753084	BLASTN	464	1e-31	75
1670	22540	700577189H1	SATMON031	g1753085	BLASTN	93	1e-19	75
1671	22540	LIB3069-023-	LIB3069	g1753084	BLASTN	264	1e-10	78
1523	23635	Q1-K1-H5 701186070H1	SATMONN06	g16334	BLASTN	116	1e-26	72
1672	23923	700211157H1	SATMON016	g1122224	BLASTN	577	1e-38	66
1673	23923	701176447H1	SATMONN05	g1905785	BLASTN	211	1e-30	70
1674	24378	LIB3069-035-	LIB3069	g21632	BLASTN	779	1e-75	83
1675	2463	Q1-K1-E11 700019837H1	SATMON001	g21634	BLASTN	584	1e-39	85
1676	2463	700085128H1	SATMON011	g21634	BLASTN	452	1e-28	80
1677	2463	700092347H1	SATMON008	g21634	BLASTN	399	1e-22	83
1678	2463	700093882H1	SATMON008	g21634	BLASTN	399	1e-22	83
1679	2463	700153109H1	SATMON007	g21634	BLASTN	738	1e-52	82
1680	2463	700157835H1	SATMON012	g21634	BLASTN	407	1e-44	80
1681	2463	700170639H1	SATMON013	g21634	BLASTN	203	1e-29	78
1682	2463	700201241H1	SATMON003	g21634	BLASTN	333	1e-39	77
1683	2463	700236219H1	SATMON010	g21634	BLASTN	555	1e-52	78
1684	2463	700239860H1	SATMON010	g21634	BLASTN	900	1e-66	84
1685	2463	700337536H1	SATMON020	g21634	BLASTN	479	1e-29	83
1686	2463	700339949H1	SATMON020	g21634	BLASTN	717	1e-66	79
1687	2463	700340335H1	SATMON020	g21634	BLASTN	466	1e-28	82
1688	2463	700468441H1	SATMON025	g21634	BLASTN	855	1e-62	82
1689	2463	700574925H1	SATMON030	g21634	BLASTN	368	1e-21	86
1690	2463	700577228H1	SATMON031	g21634	BLASTN	931	1e-68	82
1691	2463	700579628H1	SATMON031	g21634	BLASTN	529	1e-63	83
1692	2463	700623187H1	SATMON034	g21634	BLASTN	679	1e-57	79
1693	2463	LIB143-009-	LIB143	g21634	BLASTN	522	1e-65	84
1694	2463	Q1-E1-H7 LIB143-009-	LIB143	g21634	BLASTN	649	1e-45	73
1695	2463	Q1-E1-H8 LIB3066-023-	LIB3066	g21634	BLASTN	449	1e-26	81
1696	2463	Q1-K1-H9 LIB3078-004-	LIB3078	g21634	BLASTN	398	1e-33	73
1697	26326	Q1-K1-H6 LIB3062-051-	LIB3062	g2959559	BLASTN	75	1e-34	61
1698	26326	Q1-K1-A2 LIB3069-050-	LIB3069	g2959559	BLASTN	87	1e-52	54
1699	26326	Q1-K1-G8 LIB3078-004-	LIB3078	g2959559	BLASTN	87	1e-52	53
1700	26872	Q1-K1-C5 LIB3059-042-	LIB3059	g1060934	BLASTN	1193	1e-116	92
1701	26872	Q1-K1-A5 LIB3059-035-	LIB3059	g1060934	BLASTN	1407	1e-136	88
1702	27311	Q1-K1-D9 700618712H1	SATMON034	g19275	BLASTN	176	1e-26	37
1703	27311	LIB3066-025-	LIB3066	g19275	BLASTN	147	1e-36	36

		Q1-K1-A10						
1704	2795	700048240H1	SATMON003	g2281449	BLASTN	125	1e-30	72
1705	29678	700170080H1	SATMON013	g21634	BLASTN	439	1e-51	78
1706	29678	700426193H1	SATMONN01	g21635	BLASTN	98	1e-22	67
1707	29791	LIB3059-019-	LIB3059	g21634	BLASTN	971	1e-80	86
		Q1-K1-B10						
1708	30792	LIB143-040-	LIB143	g1753086	BLASTN	268	1e-38	77
		Q1-E1-F3						
1709	30792	LIB3059-056-	LIB3059	g1753086	BLASTN	268	1e-28	78
		Q1-K1-A5						
1710	398	700622334H1	SATMON034	g1769891	BLASTN	86	1e-21	46
1711	398	700623777H1	SATMON034	g1769891	BLASTN	151	1e-23	46
1712	4953	700096885H1	SATMON008	g19275	BLASTN	108	1e-21	39
1713	4953	700173030H1	SATMON013	g19275	BLASTN	167	1e-24	42
1714	4953	700221793H1	SATMON011	g19275	BLASTN	192	1e-28	40
1715	4953	700580086H1	SATMON031	g19275	BLASTN	159	1e-23	36
1716	6037	700095735H1	SATMON008	g19275	BLASTN	269	1e-39	51
1717	6037	700095783H1	SATMON008	g19275	BLASTN	264	1e-38	51
1718	6336	700102843H1	SATMON010	g1753086	BLASTN	226	1e-14	87
1719	6336	700105032H1	SATMON010	g1753086	BLASTN	226	1e-25	84
1720	6336	LIB3059-013-	LIB3059	g1753086	BLASTN	245	1e-22	81
		Q1-K1-B5						
1721	6336	LIB3061-035-	LIB3061	g1753086	BLASTN	236	1e-21	79
		Q1-K1-A12						
1722	6336	LIB3061-031-	LIB3061	g1753086	BLASTN	236	1e-21	80
		Q1-K1-A4						
1723	6336	LIB3061-043-	LIB3061	g1753086	BLASTN	236	1e-16	80
		Q1-K1-B10						

MAIZE HLH TRANSCRIPTION FACTORS

Seq No.	Cluster ID	CloneID	Library	NCBI gi	METHOD	Score	P-Value	%Ident
1724	-700030417	700030417H1	SATMON003	g1477749	BLASTN	42	1e-17	51
1725	-700151401	700151401H1	SATMON007	g22478	BLASTN	1118	1e-84	98
1726	-700171510	700171510H1	SATMON013	g1142621	BLASTN	119	1e-18	59
1727	-700171659	700171659H1	SATMON013	g2351072	BLASTN	245	1e-11	70
1728	-700205626	700205626H1	SATMON003	g1465368	BLASTN	97	1e-21	75
1729	-700342458	700342458H1	SATMON021	g1142619	BLASTN	128	1e-19	58
1730	-700344859	700344859H1	SATMON021	g1575534	BLASTN	133	1e-20	52
1731	-700428022	700428022H1	SATMONN01	g2351072	BLASTN	293	1e-13	65
1732	-700574126	700574126H1	SATMON030	g2842468	BLASTN	173	1e-33	56
1733	-700801387	700801387H1	SATMON036	g1142621	BLASTN	124	1e-19	51
1734	13465	700204307H1	SATMON003	g1142621	BLASTN	126	1e-20	36
1735	13465	700205715H1	SATMON003	g1142621	BLASTN	116	1e-18	39
1736	14163	700045811H1	SATMON004	g2351072	BLASTN	382	1e-21	69
1737	14163	700222784H1	SATMON011	g2351072	BLASTN	373	1e-22	69
1738	31730	LIB3066-012-	LIB3066	g1142619	BLASTN	54	1e-33	55
		Q1-K1-B6						
1739	32755	LIB189-008-	LIB189	g1142619	BLASTN	141	1e-43	49
		Q1-E1-D8						
1740	459	700577179H1	SATMON031	g431265	BLASTN	188	1e-09	80
1741	8305	700027525H1	SATMON003	g1465367	BLASTN	211	1e-15	72
1742	8305	700206468H1	SATMON003	g1465367	BLASTN	263	1e-19	72
1743	8305	700214194H1	SATMON016	g1465367	BLASTN	170	1e-10	73

1744	8305	700453272H1	SATMON028	g1465367	BLASTN	209	1e-15	72
1745	8305	LIB143-037-Q1-E1-E3	LIB143	g1465367	BLASTN	298	1e-21	73

SOYBEAN HOMEBOX TRANSCRIPTION FACTORS

Seq No.	Cluster ID	CloneID	Library	NCBI gi	METHOD	Score	P-Value	%Ident
1746	-700555559	700555559H1	SOYMON001	g1173621	BLASTN	439	1e-26	72
1747	-700560219	700560219H1	SOYMON001	g1173622	BLASTN	141	1e-29	53
1748	-700565743	700565743H1	SOYMON002	g2464893	BLASTN	98	1e-17	45
1749	-700649042	700649042H1	SOYMON003	g533708	BLASTN	598	1e-39	75
1750	-700651436	700651436H1	SOYMON003	g606952	BLASTN	171	1e-31	59
1751	-700654022	700654022H1	SOYMON003	g549886	BLASTN	56	1e-17	60
1752	-700659382	700659382H1	SOYMON004	g1435021	BLASTN	102	1e-20	42
1753	-700663176	700663176H1	SOYMON005	g1814423	BLASTN	572	1e-38	75
1754	-700664572	700664572H1	SOYMON005	g1814424	BLASTN	91	1e-18	64
1755	-700665913	700665913H1	SOYMON005	g507219	BLASTN	240	1e-16	64
1756	-700667947	700667947H1	SOYMON006	g507797	BLASTN	560	1e-49	75
1757	-700673793	700673793H1	SOYMON007	g930065	BLASTN	41	1e-18	47
1758	-700676275	700676275H1	SOYMON007	g1946221	BLASTN	865	1e-63	80
1759	-700684289	700684289H1	SOYMON008	g1122533	BLASTN	80	1e-17	59
1760	-700725464	700725464H1	SOYMON009	g16019	BLASTN	274	1e-22	74
1761	-700747348	700747348H1	SOYMON013	g453949	BLASTN	261	1e-46	72
1762	-700791930	700791930H1	SOYMON011	g1814424	BLASTN	110	1e-25	73
1763	-700792664	700792664H1	SOYMON017	g2464893	BLASTN	144	1e-21	50
1764	-700829533	700829533H1	SOYMON019	g767699	BLASTN	634	1e-44	83
1765	-700833881	700833881H1	SOYMON019	g2464893	BLASTN	170	1e-28	55
1766	-700839629	700839629H1	SOYMON020	g1122532	BLASTN	538	1e-35	70
1767	-700843769	700843769H1	SOYMON021	g527628	BLASTN	631	1e-43	79
1768	-700845147	700845147H1	SOYMON021	g349379	BLASTN	138	1e-25	80
1769	-700853988	700853988H1	SOYMON023	g1173829	BLASTN	454	1e-28	74
1770	-700854082	700854082H1	SOYMON023	g1881536	BLASTN	113	1e-21	62
1771	-700869580	700869580H1	SOYMON016	g767697	BLASTN	292	1e-21	66
1772	-700872483	700872483H1	SOYMON018	g1045041	BLASTN	312	1e-29	83
1773	-700890624	700890624H1	SOYMON024	g2244990	BLASTN	166	1e-24	80
1774	-700893192	700893192H1	SOYMON024	g767697	BLASTN	596	1e-40	76
1775	-700893942	700893942H1	SOYMON024	g2464893	BLASTN	159	1e-25	52
1776	-700893970	700893970H1	SOYMON024	g1008878	BLASTN	424	1e-26	66
1777	-700894248	700894248H1	SOYMON024	g666128	BLASTN	181	1e-26	66
1778	-700904909	700904909H1	SOYMON022	g453948	BLASTN	485	1e-31	81
1779	-700908207	700908207H1	SOYMON022	g2244990	BLASTN	131	1e-28	80
1780	-700910094	700910094H1	SOYMON022	g533708	BLASTN	765	1e-59	81
1781	-700942657	700942657H1	SOYMON024	g310568	BLASTN	652	1e-72	85
1782	-700943207	700943207H1	SOYMON024	g1881536	BLASTN	131	1e-31	59
1783	-700943363	700943363H1	SOYMON024	g310568	BLASTN	412	1e-43	87
1784	-700945149	700945149H1	SOYMON024	g310568	BLASTN	618	1e-52	94
1785	-700953112	700953112H1	SOYMON022	g2464893	BLASTN	131	1e-19	68
1786	-700954444	700954444H1	SOYMON022	g2388574	BLASTN	114	1e-17	100
1787	-700957315	700957315H1	SOYMON022	g499164	BLASTN	122	1e-18	51
1788	-700957441	700957441H1	SOYMON022	g2306989	BLASTN	53	1e-17	79
1789	-700958607	700958607H1	SOYMON022	g2529702	BLASTN	479	1e-51	77
1790	-700959655	700959655H1	SOYMON022	g533708	BLASTN	695	1e-49	81
1791	-700959810	700959810H1	SOYMON022	g1173829	BLASTN	539	1e-36	68

1792	-700962277	700962277H1	SOYMON022	g1814424	BLASTN	103	1e-21	46
1793	-700962294	700962294H1	SOYMON022	g1122533	BLASTN	116	1e-17	95
1794	-700964766	700964766H1	SOYMON022	g1045042	BLASTN	144	1e-23	71
1795	-700966827	700966827H1	SOYMON028	g1946221	BLASTN	481	1e-31	84
1796	-700966971	700966971H1	SOYMON029	g1946221	BLASTN	747	1e-53	77
1797	-700967672	700967672H1	SOYMON032	g527630	BLASTN	596	1e-40	77
1798	-700969205	700969205H1	SOYMON005	g527632	BLASTN	801	1e-57	79
1799	-700974644	700974644H1	SOYMON005	g507219	BLASTN	583	1e-44	75
1800	-700974946	700974946H1	SOYMON005	g666128	BLASTN	183	1e-26	62
1801	-700986825	700986825H1	SOYMON009	g1946221	BLASTN	561	1e-37	75
1802	-700989250	700989250H1	SOYMON011	g453948	BLASTN	509	1e-49	78
1803	-700992777	700992777H1	SOYMON011	g1122533	BLASTN	214	1e-31	58
1804	-700993450	700993450H1	SOYMON011	g767700	BLASTN	585	1e-39	68
1805	-700995393	700995393H1	SOYMON011	g1167915	BLASTN	488	1e-30	78
1806	-700996901	700996901H1	SOYMON018	g2464893	BLASTN	122	1e-18	75
1807	-701007678	701007678H1	SOYMON019	g166756	BLASTN	115	1e-19	100
1808	-701009713	701009713H1	SOYMON019	g2501810	BLASTN	117	1e-21	41
1809	-701009968	701009968H2	SOYMON019	g1435023	BLASTN	165	1e-25	78
1810	-701012033	701012033H1	SOYMON019	g1234900	BLASTN	138	1e-21	88
1811	-701013785	701013785H1	SOYMON019	g2464893	BLASTN	164	1e-24	93
1812	-701014405	701014405H1	SOYMON019	g1045041	BLASTN	459	1e-29	68
1813	-701037074	701037074H1	SOYMON029	g1122533	BLASTN	99	1e-18	71
1814	-701038758	701038758H1	SOYMON029	g1946221	BLASTN	628	1e-43	82
1815	-701042583	701042583H1	SOYMON029	g1946221	BLASTN	907	1e-66	86
1816	-701044439	701044439H1	SOYMON032	g1814424	BLASTN	198	1e-29	51
1817	-701044558	701044558H1	SOYMON032	g1173622	BLASTN	159	1e-24	87
1818	-701050612	701050612H1	SOYMON032	g527632	BLASTN	599	1e-41	77
1819	-701119065	701119065H1	SOYMON037	g1946221	BLASTN	451	1e-28	81
1820	-701128657	701128657H1	SOYMON037	g310568	BLASTN	593	1e-48	90
1821	-701133994	701133994H2	SOYMON038	g453949	BLASTN	247	1e-36	60
1822	-701134378	701134378H1	SOYMON038	g1435023	BLASTN	128	1e-19	87
1823	-701136723	701136723H1	SOYMON038	g19486	BLASTN	180	1e-27	57
1824	-701137384	701137384H1	SOYMON038	g606952	BLASTN	169	1e-25	57
1825	-701141686	701141686H1	SOYMON038	g349378	BLASTN	316	1e-36	74
1826	-701145388	701145388H1	SOYMON031	g453949	BLASTN	111	1e-19	67
1827	-701146987	701146987H1	SOYMON031	g549887	BLASTN	177	1e-30	71
1828	-701147041	701147041H1	SOYMON031	g1814424	BLASTN	257	1e-37	63
1829	-701205621	701205621H1	SOYMON035	g349378	BLASTN	500	1e-32	75
1830	-701206538	701206538H1	SOYMON035	g1234899	BLASTN	465	1e-29	76
1831	-701211327	701211327H1	SOYMON035	g533708	BLASTN	920	1e-67	84
1832	-701211696	701211696H1	SOYMON035	g396198	BLASTN	227	1e-17	75
1833	-701211947	701211947H1	SOYMON035	g1173621	BLASTN	446	1e-27	81
1834	-701215129	701215129H1	SOYMON035	g453948	BLASTN	437	1e-45	80
1835	10171	700953820H1	SOYMON022	g313113	BLASTN	179	1e-26	85
1836	1047	700787538H1	SOYMON011	g1122533	BLASTN	174	1e-25	40
1837	1047	700834648H1	SOYMON019	g1122533	BLASTN	190	1e-28	50
1838	1047	700834669H1	SOYMON019	g1122533	BLASTN	217	1e-31	47
1839	1047	700864996H1	SOYMON016	g1122533	BLASTN	213	1e-31	45
1840	10628	700835067H1	SOYMON019	g1435023	BLASTN	200	1e-31	82
1841	10628	700953324H1	SOYMON022	g1435023	BLASTN	130	1e-20	75
1842	10628	LIB3051-044-Q1-K1-G5	LIB3051	g767700	BLASTN	649	1e-43	77
1843	10951	700663182H1	SOYMON005	g767700	BLASTN	391	1e-40	76
1844	10951	700797519H1	SOYMON017	g767700	BLASTN	637	1e-44	76



1845	10951	700849171H1	SOYMON021	g767700	BLASTN	541	1e-36	75
1846	10951	700865713H1	SOYMON016	g499162	BLASTN	83	1e-17	58
1847	10951	700901065H1	SOYMON027	g767700	BLASTN	606	1e-41	75
1848	10951	700907319H1	SOYMON022	g767700	BLASTN	521	1e-43	74
1849	10951	700956307H1	SOYMON022	g767700	BLASTN	687	1e-48	76
1850	10951	701100975H1	SOYMON028	g1435023	BLASTN	158	1e-24	55
1851	10951	701119381H1	SOYMON037	g767700	BLASTN	646	1e-45	75
1852	10951	701127370H1	SOYMON037	g767700	BLASTN	764	1e-54	76
1853	10951	701146808H1	SOYMON031	g767700	BLASTN	398	1e-41	78
1854	10951	LIB3030-008-Q1-B1-G4	LIB3030	g767700	BLASTN	397	1e-34	73
1855	11866	700891680H1	SOYMON024	g2529703	BLASTN	140	1e-25	62
1856	12278	701066638H1	SOYMON034	g16327	BLASTN	194	1e-10	80
1857	12636	700662285H1	SOYMON005	g1234899	BLASTN	229	1e-17	81
1858	12636	701038730H1	SOYMON029	g1234899	BLASTN	184	1e-13	84
1859	13299	700843946H1	SOYMON021	g1435021	BLASTN	202	1e-29	57
1860	13299	700984301H1	SOYMON009	g1435021	BLASTN	95	1e-17	60
1861	13299	701121896H1	SOYMON037	g1435021	BLASTN	176	1e-25	58
1862	13299	LIB3040-007-Q1-E1-A1	LIB3040	g1435021	BLASTN	133	1e-36	46
1863	13344	700830015H1	SOYMON019	g349378	BLASTN	406	1e-35	84
1864	13344	701070177H1	SOYMON034	g349378	BLASTN	780	1e-61	82
1865	13595	700872792H1	SOYMON018	g1122533	BLASTN	197	1e-29	78
1866	1426	700952294H1	SOYMON022	g19357	BLASTN	390	1e-41	82
1867	15006	701109138H1	SOYMON036	g313113	BLASTN	192	1e-28	62
1868	15688	700943842H1	SOYMON024	g527628	BLASTN	788	1e-56	77
1869	15688	700979909H1	SOYMON009	g1165131	BLASTN	338	1e-21	72
1870	16	700968161H1	SOYMON035	g16155	BLASTN	356	1e-35	78
1871	16	701145163H1	SOYMON031	g313112	BLASTN	529	1e-35	79
1872	16	701208220H1	SOYMON035	g396198	BLASTN	589	1e-53	79
1873	16	701212468H1	SOYMON035	g396198	BLASTN	545	1e-49	79
1874	16	701215351H1	SOYMON035	g848998	BLASTN	865	1e-63	79
1875	16	LIB3049-006-Q1-E1-D4	LIB3049	g848998	BLASTN	1098	1e-82	79
1876	16	LIB3049-050-Q1-E1-B12	LIB3049	g396198	BLASTN	477	1e-53	79
1877	1658	700556120H1	SOYMON001	g1161574	BLASTN	259	1e-10	77
1878	1658	700559250H1	SOYMON001	g767697	BLASTN	268	1e-11	79
1879	1658	700565790H1	SOYMON002	g767697	BLASTN	247	1e-10	76
1880	1658	700653746H1	SOYMON003	g349262	BLASTN	447	1e-28	71
1881	1658	700673109H1	SOYMON006	g767697	BLASTN	261	1e-10	77
1882	1658	700685043H1	SOYMON008	g767697	BLASTN	259	1e-10	77
1883	1658	700686169H1	SOYMON008	g767697	BLASTN	268	1e-11	79
1884	1658	700741361H1	SOYMON012	g767697	BLASTN	268	1e-11	79
1885	1658	700749356H1	SOYMON013	g767697	BLASTN	268	1e-11	79
1886	1658	700797949H1	SOYMON017	g767697	BLASTN	261	1e-10	77
1887	1658	700833223H1	SOYMON019	g767697	BLASTN	268	1e-11	79
1888	1658	700834106H1	SOYMON019	g767697	BLASTN	268	1e-11	79
1889	1658	700845743H1	SOYMON021	g767697	BLASTN	261	1e-10	77
1890	1658	700848684H1	SOYMON021	g767697	BLASTN	254	1e-10	76
1891	1658	700874876H1	SOYMON018	g349263	BLASTN	102	1e-17	64
1892	1658	700906912H1	SOYMON022	g767697	BLASTN	261	1e-10	77
1893	1658	700952665H1	SOYMON022	g767697	BLASTN	261	1e-10	77
1894	1658	700974873H1	SOYMON005	g767697	BLASTN	268	1e-11	79



1895	1658	700997270H1	SOYMON018	g767697	BLASTN	268	1e-11	79
1896	1658	701012341H1	SOYMON019	g767697	BLASTN	261	1e-12	79
1897	1658	701015394H1	SOYMON019	g1161574	BLASTN	242	1e-09	83
1898	1658	701041243H1	SOYMON029	g767697	BLASTN	268	1e-11	79
1899	1658	701042768H1	SOYMON029	g767697	BLASTN	268	1e-11	79
1900	1658	701059909H1	SOYMON033	g1161574	BLASTN	623	1e-43	71
1901	1658	701063152H1	SOYMON033	g767697	BLASTN	268	1e-11	79
1902	1658	701102929H1	SOYMON028	g767697	BLASTN	240	1e-09	74
1903	1658	701106204H1	SOYMON036	g767697	BLASTN	261	1e-10	77
1904	1658	701124334H1	SOYMON037	g349262	BLASTN	406	1e-25	70
1905	1658	701149165H1	SOYMON031	g767697	BLASTN	259	1e-10	77
1906	1658	LIB3055-007-Q1-N1-C5	LIB3055	g767697	BLASTN	268	1e-11	79
1907	1658	LIB3040-041-Q1-E1-A7	LIB3040	g767697	BLASTN	250	1e-09	78
1908	1718	LIB3050-004-Q1-E1-E10	LIB3050	g2914706	BLASTN	175	1e-49	87
1909	17759	700944041H1	SOYMON024	g1435021	BLASTN	186	1e-27	65
1910	17759	700962082H1	SOYMON022	g1435021	BLASTN	176	1e-25	62
1911	17759	700989672H1	SOYMON011	g767697	BLASTN	516	1e-34	66
1912	17759	701132610H1	SOYMON038	g767695	BLASTN	362	1e-34	71
1913	17759	LIB3056-005-Q1-N1-G1	LIB3056	g166753	BLASTN	492	1e-30	68
1914	18347	700646488H1	SOYMON013	g1122533	BLASTN	223	1e-40	59
1915	18484	700731466H1	SOYMON010	g549887	BLASTN	121	1e-25	83
1916	18636	700868354H1	SOYMON016	g453948	BLASTN	462	1e-29	75
1917	18636	700868363H1	SOYMON016	g1045042	BLASTN	162	1e-24	83
1918	18636	700959894H1	SOYMON022	g453948	BLASTN	523	1e-34	79
1919	18636	LIB3040-005-Q1-E1-B5	LIB3040	g453948	BLASTN	355	1e-18	77
1920	18636	LIB3040-006-Q1-E1-B12	LIB3040	g453948	BLASTN	523	1e-79	77
1921	18636	LIB3039-044-Q1-E1-D1	LIB3039	g453948	BLASTN	523	1e-57	78
1922	19378	700681050H1	SOYMON008	g1122533	BLASTN	194	1e-37	63
1923	19378	700865851H1	SOYMON016	g1122532	BLASTN	529	1e-35	70
1924	20880	700684286H1	SOYMON008	g2464893	BLASTN	142	1e-21	54
1925	20880	700953247H1	SOYMON022	g2464893	BLASTN	124	1e-18	49
1926	21539	700990486H1	SOYMON011	g533708	BLASTN	462	1e-28	75
1927	21600	700958592H1	SOYMON022	g1814424	BLASTN	298	1e-42	74
1928	21600	700958595H1	SOYMON022	g1814424	BLASTN	311	1e-44	76
1929	21665	700757588H1	SOYMON015	g396199	BLASTN	109	1e-20	74
1930	22239	701204823H1	SOYMON035	g396198	BLASTN	859	1e-62	77
1931	22239	701207895H1	SOYMON035	g396198	BLASTN	568	1e-46	81
1932	2236	700559386H1	SOYMON001	g1234899	BLASTN	1400	1e-108	98
1933	2236	700684212H1	SOYMON008	g1234899	BLASTN	230	1e-13	92
1934	2236	700684793H1	SOYMON008	g1234899	BLASTN	383	1e-73	98
1935	2236	700684939H1	SOYMON008	g1234899	BLASTN	784	1e-90	91
1936	2236	700897221H1	SOYMON027	g1234899	BLASTN	1104	1e-83	95
1937	2236	700909715H1	SOYMON022	g1234899	BLASTN	586	1e-89	100
1938	2236	701064059H1	SOYMON034	g1234899	BLASTN	1241	1e-94	98
1939	22386	700559832H1	SOYMON001	g349378	BLASTN	236	1e-08	61
1940	22386	700730196H1	SOYMON009	g349378	BLASTN	231	1e-12	74
1941	22386	701009892H1	SOYMON019	g349378	BLASTN	231	1e-09	71

1942	22840	700605162H2	SOYMON003	g16327	BLASTN	489	1e-30	78
1943	22840	701152996H1	SOYMON031	g16327	BLASTN	614	1e-42	73
1944	23172	700897094H1	SOYMON027	g1814423	BLASTN	604	1e-41	70
1945	23172	701202488H1	SOYMON035	g1814423	BLASTN	346	1e-35	75
1946	23688	700676705H1	SOYMON007	g2464906	BLASTN	203	1e-40	78
1947	23962	700903463H1	SOYMON022	g16023	BLASTN	594	1e-40	80
1948	23962	701153884H1	SOYMON031	g16023	BLASTN	588	1e-40	82
1949	25170	701041521H1	SOYMON029	g1122533	BLASTN	171	1e-25	72
1950	25474	701012028H1	SOYMON019	g1234899	BLASTN	618	1e-52	83
1951	25474	701012112H1	SOYMON019	g1234899	BLASTN	380	1e-31	71
1952	25474	LIB3051-100-Q1-K1-D12	LIB3051	g1234900	BLASTN	157	1e-43	81
1953	2561	700762637H1	SOYMON015	g1234899	BLASTN	263	1e-12	82
1954	2561	700967837H1	SOYMON033	g1234899	BLASTN	265	1e-14	80
1955	26795	701212551H1	SOYMON035	g1045044	BLASTN	163	1e-24	78
1956	27638	701052052H1	SOYMON032	g2529701	BLASTN	171	1e-31	66
1957	27638	701054452H1	SOYMON032	g310568	BLASTN	502	1e-33	81
1958	29282	701053129H1	SOYMON032	g349381	BLASTN	147	1e-24	64
1959	29318	701064091H1	SOYMON034	g1234899	BLASTN	212	1e-16	84
1960	30433	701131088H1	SOYMON038	g767695	BLASTN	406	1e-23	75
1961	30433	LIB3051-016-Q1-E1-G10	LIB3051	g767695	BLASTN	614	1e-40	71
1962	30817	700560926H1	SOYMON001	g1814423	BLASTN	416	1e-51	77
1963	30817	700756294H1	SOYMON014	g1814423	BLASTN	506	1e-33	73
1964	30817	LIB3051-115-Q1-K1-G7	LIB3051	g1814424	BLASTN	241	1e-87	79
1965	30817	LIB3051-115-Q1-K1-G8	LIB3051	g1814423	BLASTN	486	1e-29	70
1966	31478	700755133H1	SOYMON014	g1173829	BLASTN	589	1e-40	78
1967	31478	LIB3051-048-Q1-K1-G8	LIB3051	g1173829	BLASTN	1200	1e-91	75
1968	32951	700974967H1	SOYMON005	g19486	BLASTN	138	1e-21	55
1969	32951	LIB3051-108-Q1-K1-H9	LIB3051	g19486	BLASTN	149	1e-38	55
1970	33012	LIB3040-002-Q1-E1-A3	LIB3040	g1814234	BLASTN	110	1e-36	59
1971	3353	700559837H1	SOYMON001	g767700	BLASTN	632	1e-43	74
1972	3353	700646560H1	SOYMON014	g767700	BLASTN	413	1e-54	77
1973	3353	700739015H1	SOYMON012	g1435023	BLASTN	189	1e-51	79
1974	3353	700763993H1	SOYMON019	g767700	BLASTN	648	1e-45	80
1975	3353	700832983H1	SOYMON019	g767700	BLASTN	637	1e-44	70
1976	3353	700863990H1	SOYMON016	g1435023	BLASTN	253	1e-38	65
1977	3353	700873703H1	SOYMON018	g767700	BLASTN	799	1e-57	77
1978	3353	700944678H1	SOYMON024	g767700	BLASTN	760	1e-54	78
1979	3353	701014184H1	SOYMON019	g767700	BLASTN	614	1e-56	76
1980	3353	701133677H2	SOYMON038	g767700	BLASTN	486	1e-51	74
1981	3353	701136948H1	SOYMON038	g767700	BLASTN	465	1e-28	75
1982	3353	LIB3030-007-Q1-B1-A2	LIB3030	g767700	BLASTN	1081	1e-81	75
1983	3353	LIB3051-002-Q1-E1-F10	LIB3051	g767700	BLASTN	874	1e-64	76
1984	3353	LIB3051-015-Q1-E1-E9	LIB3051	g767700	BLASTN	953	1e-70	75
1985	5429	LIB3051-108-	LIB3051	g2914706	BLASTN	129	1e-43	56

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1986	5724	700672222H1	SOYMON006	g499163	BLASTN	269	1e-11	72
1987	5724	700877190H1	SOYMON018	g499163	BLASTN	280	1e-12	71
1988	5724	700954530H1	SOYMON022	g499164	BLASTN	235	1e-34	64
1989	5724	701147769H1	SOYMON031	g499164	BLASTN	78	1e-24	58
1990	5724	LIB3030-002-Q1-B1-A10	LIB3030	g3153207	BLASTN	153	1e-45	57
1991	5936	700606207H1	SOYMON008	g349266	BLASTN	452	1e-29	80
1992	7300	700671024H1	SOYMON006	g1435023	BLASTN	149	1e-22	71
1993	7300	700788665H1	SOYMON011	g1435023	BLASTN	212	1e-32	75
1994	7484	LIB3065-014-Q1-N1-F3	LIB3065	g499162	BLASTN	93	1e-38	62
1995	7661	700728721H1	SOYMON009	g767697	BLASTN	637	1e-44	75
1996	7661	700871987H1	SOYMON018	g767695	BLASTN	579	1e-39	76
1997	7661	700874351H1	SOYMON018	g767695	BLASTN	555	1e-37	74
1998	7661	700876296H1	SOYMON018	g1435021	BLASTN	190	1e-36	75
1999	8490	701036975H1	SOYMON029	g2464893	BLASTN	197	1e-28	69
2000	9415	700865525H1	SOYMON016	g1122532	BLASTN	501	1e-32	70

SOYBEAN HLH TRANSCRIPTION FACTORS

Seq No.	Cluster ID	CloneID	Library	NCBI gi	METHOD	Score	P-Value	%Identity
2001	-700555065	700555065H1	SOYMON001	g1142618	BLASTN	434	1e-70	84
2002	-700559493	700559493H1	SOYMON001	g53018	BLASTN	131	1e-38	74
2003	-700667019	700667019H1	SOYMON005	g1142618	BLASTN	777	1e-55	83
2004	-700685842	700685842H1	SOYMON008	g2351072	BLASTN	453	1e-27	74
2005	-700727678	700727678H1	SOYMON009	g1142619	BLASTN	115	1e-17	79
2006	-700789561	700789561H2	SOYMON011	g2351072	BLASTN	231	1e-20	69
2007	-700876112	700876112H1	SOYMON018	g1154626	BLASTN	328	1e-30	80
2008	-700898156	700898156H1	SOYMON027	g1142618	BLASTN	370	1e-40	78
2009	-700909057	700909057H1	SOYMON022	g1142618	BLASTN	461	1e-29	88
2010	-700953178	700953178H1	SOYMON022	g1142619	BLASTN	85	1e-20	89
2011	-700963882	700963882H1	SOYMON022	g2351072	BLASTN	621	1e-43	73
2012	-700969727	700969727H1	SOYMON005	g2351072	BLASTN	192	1e-09	73
2013	-700981519	700981519H1	SOYMON009	g1142619	BLASTN	220	1e-32	86
2014	-700982772	700982772H1	SOYMON009	g1142618	BLASTN	536	1e-49	81
2015	-700992250	700992250H1	SOYMON011	g1142618	BLASTN	529	1e-35	73
2016	-700995549	700995549H1	SOYMON011	g1154626	BLASTN	378	1e-39	74
2017	-701061047	701061047H1	SOYMON033	g527663	BLASTN	67	1e-18	49
2018	-701065109	701065109H1	SOYMON034	g527663	BLASTN	67	1e-17	52
2019	-701098613	701098613H1	SOYMON028	g2351072	BLASTN	409	1e-23	67
2020	-701099791	701099791H1	SOYMON028	g1142618	BLASTN	535	1e-35	73
2021	-701104269	701104269H1	SOYMON036	g2351072	BLASTN	270	1e-11	81
2022	-701105510	701105510H1	SOYMON036	g1154626	BLASTN	142	1e-26	79
2023	-701108367	701108367H1	SOYMON036	g1142618	BLASTN	934	1e-68	84
2024	-701148492	701148492H1	SOYMON031	g2351072	BLASTN	574	1e-38	75
2025	-701154036	701154036H1	SOYMON031	g2351072	BLASTN	588	1e-41	86
2026	10449	700872082H1	SOYMON018	g1154626	BLASTN	395	1e-34	77
2027	11917	700749314H1	SOYMON013	g527653	BLASTN	68	1e-18	45
2028	16	700658882H1	SOYMON004	g343349	BLASTN	580	1e-39	100
2029	16	700789347H2	SOYMON011	g343349	BLASTN	620	1e-43	100
2030	16	700970836H1	SOYMON005	g343349	BLASTN	559	1e-37	97
2031	16	700972287H1	SOYMON005	g343349	BLASTN	405	1e-46	98

2032	16	LIB3049-025-Q1-E1-H12	LIB3049	g343349	BLASTN	624	1e-43	98
2033	16	LIB3040-018-Q1-E1-D9	LIB3040	g343349	BLASTN	690	1e-48	97
2034	16	LIB3040-044-Q1-E1-F7	LIB3040	g343349	BLASTN	522	1e-34	98
2035	16	LIB3040-049-Q1-E1-G6	LIB3040	g343349	BLASTN	678	1e-47	97
2036	16	LIB3049-002-Q1-E1-E2	LIB3049	g343349	BLASTN	344	1e-18	79
2037	16785	700653875H1	SOYMON003	g1154626	BLASTN	611	1e-41	77
2038	18672	700899094H1	SOYMON027	g1142619	BLASTN	170	1e-24	58
2039	18672	700899263H1	SOYMON027	g1142619	BLASTN	144	1e-21	66
2040	19346	700761358H1	SOYMON015	g1465368	BLASTN	249	1e-36	88
2041	20124	700869958H1	SOYMON016	g1142619	BLASTN	139	1e-21	89
2042	20124	701107971H1	SOYMON036	g1142618	BLASTN	431	1e-27	81
2043	20916	701102444H1	SOYMON028	g2351072	BLASTN	290	1e-12	72
2044	2148	700553590H1	SOYMON001	g1465367	BLASTN	216	1e-31	74
2045	2148	700553889H1	SOYMON001	g1465367	BLASTN	225	1e-17	70
2046	2148	700660115H1	SOYMON004	g1465367	BLASTN	182	1e-22	75
2047	2148	700746715H1	SOYMON013	g1465367	BLASTN	198	1e-19	73
2048	2148	700752031H1	SOYMON014	g1465367	BLASTN	200	1e-26	71
2049	2148	700835783H1	SOYMON019	g1465367	BLASTN	168	1e-14	76
2050	25927	701015416H1	SOYMON019	g1465367	BLASTN	205	1e-29	77
2051	25927	701066344H1	SOYMON034	g1465367	BLASTN	246	1e-09	64
2052	25927	701150978H1	SOYMON031	g1465367	BLASTN	196	1e-19	75
2053	3134	700560257H1	SOYMON001	g2351072	BLASTN	306	1e-44	78
2054	3134	700698382H1	SOYMON017	g2351072	BLASTN	345	1e-35	77
2055	3134	700730295H1	SOYMON009	g2351072	BLASTN	281	1e-20	72
2056	3134	700747260H1	SOYMON013	g2351072	BLASTN	300	1e-44	76
2057	3134	700752110H1	SOYMON014	g2351072	BLASTN	345	1e-44	77
2058	3134	700756323H1	SOYMON014	g2351072	BLASTN	345	1e-44	77
2059	3134	700790347H2	SOYMON011	g2351072	BLASTN	254	1e-09	67
2060	3134	700896017H1	SOYMON027	g2351072	BLASTN	303	1e-40	77
2061	3134	700957024H1	SOYMON022	g2351072	BLASTN	300	1e-39	77
2062	3134	700964178H1	SOYMON022	g2351072	BLASTN	345	1e-41	79
2063	3134	700982832H1	SOYMON009	g2351072	BLASTN	345	1e-33	77
2064	3134	701051341H1	SOYMON032	g2351072	BLASTN	281	1e-40	77
2065	3134	701104855H1	SOYMON036	g2351072	BLASTN	292	1e-21	73
2066	3134	701124738H1	SOYMON037	g2351072	BLASTN	281	1e-21	73
2067	3134	701137532H1	SOYMON038	g2351072	BLASTN	324	1e-21	75
2068	3134	701215342H1	SOYMON035	g2351072	BLASTN	287	1e-21	73
2069	3134	LIB3051-017-Q1-E1-C6	LIB3051	g2351072	BLASTN	340	1e-31	76
2070	3134	LIB3051-010-Q1-E1-H3	LIB3051	g2351072	BLASTN	345	1e-40	77
2071	32315	LIB3051-014-Q1-E1-A8	LIB3051	g2351072	BLASTN	385	1e-20	82
2072	32639	LIB3051-023-Q1-K1-A8	LIB3051	g2351072	BLASTN	569	1e-35	72
2073	33704	LIB3027-005-Q1-B1-E1	LIB3027	g3036810	BLASTN	176	1e-42	66
2074	33819	701065242H1	SOYMON034	g2351072	BLASTN	245	1e-09	64
2075	33819	LIB3051-041-	LIB3051	g2351072	BLASTN	311	1e-27	69



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2076	5988	700557524H1	SOYMON001	g1142618	BLASTN	270	1e-12	81
2077	5988	700746259H1	SOYMON013	g1142619	BLASTN	116	1e-18	64
2078	5988	700749920H1	SOYMON013	g1142618	BLASTN	259	1e-27	75
2079	5988	700868390H1	SOYMON016	g1142619	BLASTN	113	1e-24	76
2080	5988	700900650H1	SOYMON027	g1142618	BLASTN	259	1e-23	70
2081	5988	700984856H1	SOYMON009	g1142618	BLASTN	243	1e-29	77
2082	5988	700991037H1	SOYMON011	g1142618	BLASTN	238	1e-10	74
2083	5988	701000541H1	SOYMON018	g1142618	BLASTN	259	1e-10	81
2084	5988	701130184H1	SOYMON037	g1142618	BLASTN	259	1e-11	81
2085	9168	701040904H1	SOYMON029	g2351072	BLASTN	279	1e-12	73

SOYBEAN LEUCINE ZIPPER TRANSCRIPTION FACTORS

Seq No.	Cluster ID	CloneID	Library	NCBI gi	METHOD	Score	P-Value	%Ident
2086	-700561911	700561911H1	SOYMON002	g2244744	BLASTN	70	1e-24	52
2087	-700645762	700645762H1	SOYMON010	g600854	BLASTN	420	1e-24	76
2088	-700651877	700651877H1	SOYMON003	g2253278	BLASTN	150	1e-22	48
1752	-700659382	700659382H1	SOYMON004	g1435021	BLASTN	102	1e-20	42
2089	-700664867	700664867H1	SOYMON005	g1905785	BLASTN	136	1e-36	62
2090	-700666259	700666259H1	SOYMON005	g19275	BLASTN	211	1e-31	45
2091	-700668136	700668136H1	SOYMON006	g19275	BLASTN	128	1e-19	50
2092	-700673243	700673243H1	SOYMON006	g179969	BLASTN	187	1e-27	50
2093	-700683530	700683530H1	SOYMON008	g2244744	BLASTN	192	1e-30	46
2094	-700726285	700726285H1	SOYMON009	g2317905	BLASTN	116	1e-20	70
2095	-700729493	700729493H1	SOYMON009	g19274	BLASTN	583	1e-39	76
2096	-700734757	700734757H1	SOYMON010	g600855	BLASTN	161	1e-23	36
2097	-700748271	700748271H1	SOYMON013	g1354856	BLASTN	216	1e-10	85
2098	-700749120	700749120H1	SOYMON013	g19275	BLASTN	119	1e-19	72
2099	-700753224	700753224H1	SOYMON014	g2317905	BLASTN	146	1e-22	84
2100	-700755845	700755845H1	SOYMON014	g19275	BLASTN	120	1e-18	69
2101	-700758569	700758569H1	SOYMON015	g2246376	BLASTN	116	1e-17	39
2102	-700790606	700790606H2	SOYMON011	g2244744	BLASTN	114	1e-18	60
2103	-700791712	700791712H1	SOYMON011	g1052959	BLASTN	542	1e-47	86
2104	-700793594	700793594H1	SOYMON017	g600854	BLASTN	784	1e-56	77
2105	-700794075	700794075H1	SOYMON017	g600855	BLASTN	165	1e-24	73
2106	-700795892	700795892H1	SOYMON017	g2264378	BLASTN	149	1e-22	61
1764	-700829533	700829533H1	SOYMON019	g767699	BLASTN	634	1e-44	83
2107	-700834555	700834555H1	SOYMON019	g600855	BLASTN	138	1e-21	34
2108	-700834891	700834891H1	SOYMON019	g1769891	BLASTN	155	1e-23	55
2109	-700836073	700836073H1	SOYMON019	g2244744	BLASTN	121	1e-19	59
2110	-700836512	700836512H1	SOYMON020	g2253278	BLASTN	146	1e-22	85
2111	-700846936	700846936H1	SOYMON021	g1905785	BLASTN	170	1e-25	47
2112	-700847523	700847523H1	SOYMON021	g1769890	BLASTN	363	1e-19	77
2113	-700848955	700848955H1	SOYMON021	g1806261	BLASTN	86	1e-18	63
2114	-700851525	700851525H1	SOYMON023	g19275	BLASTN	169	1e-29	46
2115	-700852828	700852828H1	SOYMON023	g2264378	BLASTN	117	1e-19	63
2116	-700868689	700868689H1	SOYMON016	g2317905	BLASTN	130	1e-25	73
1771	-700869580	700869580H1	SOYMON016	g767697	BLASTN	292	1e-21	66
2117	-700874241	700874241H1	SOYMON018	g2317905	BLASTN	120	1e-18	53
2118	-700888837	700888837H1	SOYMON024	g2104676	BLASTN	521	1e-34	78
2119	-700890849	700890849H1	SOYMON024	g170284	BLASTN	244	1e-09	77
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1774	-700893192	700893192H1	SOYMON024	g767697	BLASTN	596	1e-40	76
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2122	-700909752	700909752H1	SOYMON022	g435944	BLASTN	112	1e-17	48
2123	-700952976	700952976H1	SOYMON022	g1806261	BLASTN	79	1e-17	68
2124	-700960533	700960533H1	SOYMON022	g1354856	BLASTN	652	1e-69	89
2125	-700962359	700962359H1	SOYMON022	g19275	BLASTN	84	1e-20	36
2126	-700970658	700970658H1	SOYMON005	g19275	BLASTN	193	1e-28	53
2127	-700972495	700972495H1	SOYMON005	g179969	BLASTN	101	1e-18	46
2128	-700974981	700974981H1	SOYMON005	g2264378	BLASTN	86	1e-26	64
2129	-700981471	700981471H1	SOYMON009	g2104674	BLASTN	952	1e-70	84
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2133	-700999491	700999491H1	SOYMON018	g19275	BLASTN	119	1e-30	46
2134	-701006225	701006225H2	SOYMON019	g2104674	BLASTN	466	1e-59	80
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2137	-701012878	701012878H1	SOYMON019	g19275	BLASTN	156	1e-25	43
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2142	-701099882	701099882H1	SOYMON028	g19275	BLASTN	112	1e-28	47
2143	-701103732	701103732H1	SOYMON036	g21634	BLASTN	544	1e-36	80
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1845	10951	700849171H1	SOYMON021	g767700	BLASTN	541	1e-36	75
1847	10951	700901065H1	SOYMON027	g767700	BLASTN	606	1e-41	75
1848	10951	700907319H1	SOYMON022	g767700	BLASTN	521	1e-43	74
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1853	10951	701146808H1	SOYMON031	g767700	BLASTN	398	1e-41	78
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2155	12495	700841043H1	SOYMON020	g19274	BLASTN	601	1e-41	74
2156	12495	701047778H1	SOYMON032	g19274	BLASTN	555	1e-37	67
2157	12495	701106992H1	SOYMON036	g19274	BLASTN	634	1e-43	74
2158	12495	LIB3051-071-Q1-K1-D6	LIB3051	g19274	BLASTN	848	1e-60	69
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1860	13299	700984301H1	SOYMON009	g1435021	BLASTN	95	1e-17	60
1861	13299	701121896H1	SOYMON037	g1435021	BLASTN	176	1e-25	58
1862	13299	LIB3040-007-Q1-E1-A1	LIB3040	g1435021	BLASTN	133	1e-36	46
2159	1346	700605422H2	SOYMON004	g1052960	BLASTN	120	1e-18	94
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2162	1346	700788035H1	SOYMON011	g1033195	BLASTN	91	1e-17	73
2163	1346	701000501H1	SOYMON018	g1052960	BLASTN	125	1e-19	86
2164	1346	701105155H1	SOYMON036	g1052960	BLASTN	150	1e-22	96
2165	1346	701206569H1	SOYMON035	g1052960	BLASTN	120	1e-18	66
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2174	15359	700727763H1	SOYMON009	g2253277	BLASTN	593	1e-40	73
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2182	16380	700557785H1	SOYMON001	g1052959	BLASTN	687	1e-63	82
2183	16380	700742445H1	SOYMON012	g1052959	BLASTN	697	1e-49	85
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1905	1658	701149165H1	SOYMON031	g767697	BLASTN	259	1e-10	77
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1910	17759	700962082H1	SOYMON022	g1435021	BLASTN	176	1e-25	62
1911	17759	700989672H1	SOYMON011	g767697	BLASTN	516	1e-34	66
1912	17759	701132610H1	SOYMON038	g767695	BLASTN	362	1e-34	71
2188	18428	700663968H1	SOYMON005	g21634	BLASTN	385	1e-21	71
2189	18428	701105724H1	SOYMON036	g21634	BLASTN	220	1e-13	79
2190	18829	700865466H1	SOYMON016	g2104674	BLASTN	867	1e-63	79
2191	18829	700869767H1	SOYMON016	g2104674	BLASTN	882	1e-64	81
2192	19335	700680951H1	SOYMON008	g21634	BLASTN	353	1e-18	70
2193	19537	700679859H1	SOYMON007	g1769891	BLASTN	236	1e-36	64
2194	19537	701041921H1	SOYMON029	g1769891	BLASTN	175	1e-27	58
2195	19537	701099652H1	SOYMON028	g1769891	BLASTN	154	1e-43	69
2196	19537	LIB3051-088-Q1-K1-F7	LIB3051	g1865679	BLASTN	253	1e-54	64
2197	19580	700678758H1	SOYMON007	g2244741	BLASTN	356	1e-18	71
2198	19580	700897588H1	SOYMON027	g394735	BLASTN	319	1e-15	80
2199	19841	700959859H1	SOYMON022	g600855	BLASTN	120	1e-18	36
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2203	20396	701104460H1	SOYMON036	g1033194	BLASTN	676	1e-47	76
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2205	20396	701145282H1	SOYMON031	g1033194	BLASTN	472	1e-40	77
2206	20396	701215204H1	SOYMON035	g1033194	BLASTN	793	1e-57	83
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2213	20815	701215050H1	SOYMON035	g2244741	BLASTN	268	1e-12	75
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1933	2236	700684212H1	SOYMON008	g1234899	BLASTN	230	1e-13	92
1934	2236	700684793H1	SOYMON008	g1234899	BLASTN	383	1e-73	98

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1978	3353	700944678H1	SOYMON024	g767700	BLASTN	760	1e-54	78
1979	3353	701014184H1	SOYMON019	g767700	BLASTN	614	1e-56	76
1980	3353	701133677H2	SOYMON038	g767700	BLASTN	486	1e-51	74
1981	3353	701136948H1	SOYMON038	g767700	BLASTN	465	1e-28	75
1982	3353	LIB3030-007-Q1-B1-A2	LIB3030	g767700	BLASTN	1081	1e-81	75
1983	3353	LIB3051-002-Q1-E1-F10	LIB3051	g767700	BLASTN	874	1e-64	76
1984	3353	LIB3051-015-Q1-E1-E9	LIB3051	g767700	BLASTN	953	1e-70	75
2246	3930	700786961H2	SOYMON011	g19275	BLASTN	170	1e-25	78
2247	3930	700831960H1	SOYMON019	g19275	BLASTN	147	1e-22	77
2248	3930	700952739H1	SOYMON022	g19275	BLASTN	164	1e-29	67
2249	3930	701012333H1	SOYMON019	g19275	BLASTN	147	1e-21	77
2250	3930	701037531H1	SOYMON029	g19275	BLASTN	159	1e-23	73
2251	3930	701106748H1	SOYMON036	g19275	BLASTN	163	1e-32	67
2252	3930	701120422H1	SOYMON037	g19275	BLASTN	163	1e-24	44
2253	3930	LIB3030-011-Q1-B1-H9	LIB3030	g19275	BLASTN	153	1e-55	54
2254	3930	LIB3049-007-Q1-E1-H11	LIB3049	g19275	BLASTN	170	1e-46	69
2255	3942	700563590H1	SOYMON002	g1060934	BLASTN	255	1e-10	86
2256	3942	700566102H1	SOYMON002	g1060934	BLASTN	270	1e-12	86
2257	3942	700676941H1	SOYMON007	g1060934	BLASTN	285	1e-12	82
2258	3942	700683676H1	SOYMON008	g1060934	BLASTN	271	1e-11	79
2259	3942	700747213H1	SOYMON013	g1060934	BLASTN	285	1e-12	82
2260	3942	700750280H1	SOYMON013	g2244743	BLASTN	263	1e-11	82
2261	3942	700807573H1	SOYMON016	g1060934	BLASTN	276	1e-11	80
2262	3942	700831802H1	SOYMON019	g1060934	BLASTN	244	1e-09	86
2263	3942	700868674H1	SOYMON016	g2244743	BLASTN	302	1e-14	71
2264	3942	700872614H1	SOYMON018	g1060934	BLASTN	244	1e-09	81
2265	3942	700899657H1	SOYMON027	g1060934	BLASTN	187	1e-08	80
2266	3942	700959339H1	SOYMON022	g2244743	BLASTN	242	1e-09	81
2267	3942	701099951H1	SOYMON028	g2244743	BLASTN	242	1e-13	73
2268	3942	701212286H1	SOYMON035	g2244743	BLASTN	256	1e-10	82
2269	3942	LIB3055-011-Q1-N1-G6	LIB3055	g1060934	BLASTN	278	1e-24	78
2270	3942	LIB3065-007-Q1-N1-B3	LIB3065	g1060934	BLASTN	269	1e-11	79
2271	3942	LIB3050-006-Q1-E1-F10	LIB3050	g394735	BLASTN	246	1e-09	90
1990	5724	LIB3030-002-Q1-B1-A10	LIB3030	g3153207	BLASTN	153	1e-45	57
2272	6898	700653220H1	SOYMON003	g1769890	BLASTN	237	1e-09	71
2273	6898	700662807H1	SOYMON005	g1769890	BLASTN	339	1e-17	71
2274	6898	701097528H1	SOYMON028	g1769890	BLASTN	328	1e-16	71
1992	7300	700671024H1	SOYMON006	g1435023	BLASTN	149	1e-22	71
1993	7300	700788665H1	SOYMON011	g1435023	BLASTN	212	1e-32	75
1995	7661	700728721H1	SOYMON009	g767697	BLASTN	637	1e-44	75
1996	7661	700871987H1	SOYMON018	g767695	BLASTN	579	1e-39	76
1997	7661	700874351H1	SOYMON018	g767695	BLASTN	555	1e-37	74
1998	7661	700876296H1	SOYMON018	g1435021	BLASTN	190	1e-36	75
2275	826	700731927H1	SOYMON010	g2317905	BLASTN	115	1e-17	43

SOYBEAN ZINC FINGER TRANSCRIPTION FACTORS

Seq No.	Cluster ID	CloneID	Library	NCBI gi	METHOD	Score	P-Value	%Ident
2276	-700555204	700555204H1	SOYMON001	g1871188	BLASTN	84	1e-17	43
2277	-700561617	700561617H1	SOYMON002	g1872521	BLASTN	147	1e-27	76
2278	-700565304	700565304H1	SOYMON002	g1304599	BLASTN	127	1e-19	66
2279	-700566572	700566572H1	SOYMON002	g2262138	BLASTN	243	1e-35	79
2280	-700650851	700650851H1	SOYMON003	g2565032	BLASTN	109	1e-23	48
2281	-700652923	700652923H1	SOYMON003	g170624	BLASTN	120	1e-18	63
2282	-700663736	700663736H1	SOYMON005	g2191172	BLASTN	185	1e-27	77
2283	-700675341	700675341H1	SOYMON007	g1800278	BLASTN	345	1e-35	72
2284	-700677659	700677659H1	SOYMON007	g1871188	BLASTN	119	1e-18	66
2285	-700678063	700678063H1	SOYMON007	g1946361	BLASTN	184	1e-27	57
2286	-700678783	700678783H1	SOYMON007	g1321818	BLASTN	129	1e-22	62
2287	-700683873	700683873H1	SOYMON008	g1872522	BLASTN	273	1e-12	63
2288	-700685541	700685541H1	SOYMON008	g1360087	BLASTN	465	1e-30	75
2289	-700686166	700686166H1	SOYMON008	g2340088	BLASTN	136	1e-24	59
2290	-700734774	700734774H1	SOYMON010	g1871192	BLASTN	212	1e-48	67
2291	-700740434	700740434H1	SOYMON012	g1321818	BLASTN	127	1e-22	55
2292	-700746763	700746763H1	SOYMON013	g2191172	BLASTN	144	1e-21	62
2293	-700748587	700748587H1	SOYMON013	g2191172	BLASTN	118	1e-29	56
2294	-700749618	700749618H1	SOYMON013	g469801	BLASTN	123	1e-19	44
2295	-700789055	700789055H2	SOYMON011	g1871192	BLASTN	137	1e-23	86
2296	-700794491	700794491H1	SOYMON017	g2191172	BLASTN	172	1e-25	70
2297	-700832582	700832582H1	SOYMON019	g2464919	BLASTN	139	1e-21	66
2298	-700838102	700838102H1	SOYMON020	g1871192	BLASTN	76	1e-19	63
2299	-700841015	700841015H1	SOYMON020	g1871192	BLASTN	194	1e-28	77
2300	-700842983	700842983H1	SOYMON020	g1871192	BLASTN	85	1e-20	71
2301	-700847070	700847070H1	SOYMON021	g18766	BLASTN	946	1e-70	87
2302	-700849930	700849930H1	SOYMON023	g1800279	BLASTN	133	1e-24	88
2303	-700852321	700852321H1	SOYMON023	g1360078	BLASTN	181	1e-35	78
2304	-700854559	700854559H1	SOYMON023	g1871192	BLASTN	202	1e-29	66
2305	-700856529	700856529H1	SOYMON023	g1228035	BLASTN	122	1e-25	43
2306	-700865957	700865957H1	SOYMON016	g1871192	BLASTN	154	1e-23	53
2307	-700867713	700867713H1	SOYMON016	g2340088	BLASTN	170	1e-25	68
2308	-700868865	700868865H1	SOYMON016	g1871192	BLASTN	115	1e-19	54
2309	-700874648	700874648H1	SOYMON018	g2058503	BLASTN	166	1e-11	86
2310	-700877141	700877141H1	SOYMON018	g2262138	BLASTN	196	1e-29	90
2118	-700888837	700888837H1	SOYMON024	g2104676	BLASTN	521	1e-34	78
2311	-700891917	700891917H1	SOYMON024	g18819	BLASTN	271	1e-49	63
2312	-700891991	700891991H1	SOYMON024	g1946361	BLASTN	104	1e-28	65
2313	-700894722	700894722H1	SOYMON024	g1871192	BLASTN	96	1e-22	68
2314	-700895992	700895992H1	SOYMON027	g2262176	BLASTN	241	1e-37	73
2315	-700897127	700897127H1	SOYMON027	g2262138	BLASTN	182	1e-27	83
2316	-700901918	700901918H1	SOYMON027	g1871192	BLASTN	206	1e-34	64
2317	-700907410	700907410H1	SOYMON022	g558543	BLASTN	129	1e-19	100
2318	-700909203	700909203H1	SOYMON022	g2582644	BLASTN	319	1e-15	70
2319	-700909471	700909471H1	SOYMON022	g173142	BLASTN	174	1e-38	64
2320	-700909487	700909487H1	SOYMON022	g2464919	BLASTN	161	1e-23	74
2321	-700944619	700944619H1	SOYMON024	g1360077	BLASTN	570	1e-38	84
2322	-700944719	700944719H1	SOYMON024	g18819	BLASTN	220	1e-32	71
2323	-700953795	700953795H1	SOYMON022	g1871192	BLASTN	209	1e-38	70

2324	-700965266	700965266H1	SOYMON022	g558542	BLASTN	323	1e-18	82
2325	-700967654	700967654H1	SOYMON032	g170216	BLASTN	695	1e-64	84
2326	-700969294	700969294H1	SOYMON005	g732811	BLASTN	162	1e-26	91
2327	-700971208	700971208H1	SOYMON005	g1871192	BLASTN	116	1e-24	66
2328	-700971551	700971551H1	SOYMON005	g558542	BLASTN	682	1e-88	94
2329	-700972802	700972802H1	SOYMON005	g2708744	BLASTN	176	1e-31	59
2330	-700974243	700974243H1	SOYMON005	g2464919	BLASTN	137	1e-20	63
2331	-700974736	700974736H1	SOYMON005	g1359493	BLASTN	279	1e-43	77
2332	-700974869	700974869H1	SOYMON005	g2708744	BLASTN	113	1e-35	68
2333	-700976868	700976868H1	SOYMON009	g2340088	BLASTN	113	1e-17	35
2334	-700978854	700978854H1	SOYMON009	g790679	BLASTN	61	1e-20	55
2335	-700983348	700983348H1	SOYMON009	g1800279	BLASTN	68	1e-22	74
2336	-700985382	700985382H1	SOYMON009	g2262176	BLASTN	78	1e-17	53
2337	-700985727	700985727H1	SOYMON009	g790683	BLASTN	159	1e-28	70
2338	-700987679	700987679H1	SOYMON009	g1871192	BLASTN	157	1e-23	60
2339	-700992259	700992259H1	SOYMON011	g439493	BLASTN	265	1e-39	59
2340	-700999030	700999030H1	SOYMON018	g1871192	BLASTN	80	1e-22	58
2341	-700999496	700999496H1	SOYMON018	g2191172	BLASTN	153	1e-22	75
2342	-701005606	701005606H1	SOYMON019	g1321818	BLASTN	122	1e-18	43
2343	-701006247	701006247H2	SOYMON019	g2191172	BLASTN	121	1e-18	40
2344	-701008075	701008075H1	SOYMON019	g1773040	BLASTN	99	1e-17	61
2345	-701012848	701012848H1	SOYMON019	g1773040	BLASTN	177	1e-39	61
2346	-701015424	701015424H1	SOYMON019	g2464919	BLASTN	201	1e-38	73
2347	-701042157	701042157H1	SOYMON029	g1360078	BLASTN	82	1e-18	69
2348	-701045915	701045915H1	SOYMON032	g18819	BLASTN	162	1e-24	71
2349	-701046568	701046568H1	SOYMON032	g558543	BLASTN	119	1e-18	60
2350	-701046893	701046893H1	SOYMON032	g2262176	BLASTN	119	1e-18	45
2351	-701046954	701046954H1	SOYMON032	g1360086	BLASTN	168	1e-27	100
2352	-701048894	701048894H1	SOYMON032	g2088668	BLASTN	124	1e-19	66
2353	-701053977	701053977H1	SOYMON032	g2582642	BLASTN	442	1e-26	74
2354	-701056738	701056738H1	SOYMON032	g1871192	BLASTN	116	1e-17	60
2355	-701059201	701059201H1	SOYMON033	g558543	BLASTN	141	1e-37	58
2356	-701063636	701063636H1	SOYMON033	g558542	BLASTN	350	1e-60	98
2357	-701064826	701064826H1	SOYMON034	g2435518	BLASTN	125	1e-20	47
2358	-701070093	701070093H2	SOYMON034	g2464919	BLASTN	107	1e-17	47
2359	-701097644	701097644H1	SOYMON028	g2340088	BLASTN	121	1e-22	67
2360	-701103165	701103165H1	SOYMON028	g1360078	BLASTN	160	1e-24	68
2361	-701103336	701103336H1	SOYMON028	g1418323	BLASTN	127	1e-24	60
2362	-701105357	701105357H1	SOYMON036	g1871192	BLASTN	77	1e-21	57
2363	-701108775	701108775H1	SOYMON036	g1297186	BLASTN	190	1e-28	82
2364	-701110093	701110093H1	SOYMON036	g1871192	BLASTN	125	1e-19	81
2365	-701121026	701121026H1	SOYMON037	g1786133	BLASTN	277	1e-18	84
2366	-701121517	701121517H1	SOYMON037	g170216	BLASTN	483	1e-30	89
2367	-701123152	701123152H1	SOYMON037	g1304599	BLASTN	208	1e-30	48
2368	-701126225	701126225H1	SOYMON037	g1800279	BLASTN	182	1e-51	74
2369	-701131709	701131709H1	SOYMON038	g2827537	BLASTN	141	1e-28	64
2370	-701139073	701139073H1	SOYMON038	g1360084	BLASTN	152	1e-26	70
2371	-701142618	701142618H1	SOYMON038	g732811	BLASTN	187	1e-29	89
2372	-701203729	701203729H2	SOYMON035	g2262176	BLASTN	69	1e-18	48
2373	-701205427	701205427H1	SOYMON035	g1321818	BLASTN	124	1e-19	30
2374	-701205779	701205779H1	SOYMON035	g2262176	BLASTN	190	1e-32	55
2375	-701208645	701208645H1	SOYMON035	g790679	BLASTN	159	1e-24	66
2376	10653	LIB3029-002-Q1-B1-F9	LIB3029	g1871192	BLASTN	254	1e-53	52

2377	10760	700658055H1	SOYMON004	g1658054	BLASTN	125	1e-19	42
2378	10795	LIB3039-004-Q1-E1-B1	LIB3039	g2190184	BLASTN	122	1e-33	48
2379	11064	700559483H1	SOYMON001	g1773040	BLASTN	164	1e-30	55
2380	11064	700726118H1	SOYMON009	g1773040	BLASTN	164	1e-24	56
2381	11064	700897260H1	SOYMON027	g1773040	BLASTN	157	1e-23	58
2382	11064	LIB3039-035-Q1-E1-E9	LIB3039	g3152606	BLASTN	296	1e-67	77
2383	1182	700648937H1	SOYMON003	g1871192	BLASTN	82	1e-26	65
2384	1182	700654076H1	SOYMON003	g1871192	BLASTN	82	1e-18	64
2385	1182	701120146H1	SOYMON037	g1871192	BLASTN	86	1e-19	57
2386	12583	700674564H1	SOYMON007	g1871192	BLASTN	121	1e-28	60
2387	12583	701133796H1	SOYMON038	g1871192	BLASTN	122	1e-24	64
2388	1281	700553557H1	SOYMON001	g2058504	BLASTN	103	1e-23	59
2389	1281	700555485H1	SOYMON001	g439493	BLASTN	74	1e-22	82
2390	1281	700561288H1	SOYMON002	g2058504	BLASTN	62	1e-21	76
2391	1281	700563970H1	SOYMON002	g439489	BLASTN	94	1e-20	89
2392	1281	700654576H1	SOYMON004	g2058504	BLASTN	56	1e-18	69
2393	1281	700671995H1	SOYMON006	g2058504	BLASTN	103	1e-21	57
2394	1281	700683252H1	SOYMON008	g2058504	BLASTN	103	1e-23	59
2395	1281	700792684H1	SOYMON017	g2058504	BLASTN	103	1e-24	54
2396	1281	700794216H1	SOYMON017	g2058504	BLASTN	107	1e-23	56
2397	1281	700833508H1	SOYMON019	g439493	BLASTN	59	1e-19	82
2398	1281	700834525H1	SOYMON019	g2058504	BLASTN	103	1e-23	59
2399	1281	700898916H1	SOYMON027	g439493	BLASTN	74	1e-22	73
2400	1281	701006403H1	SOYMON019	g439489	BLASTN	66	1e-21	80
2401	1281	701012761H1	SOYMON019	g439493	BLASTN	73	1e-19	70
2402	1281	701046493H1	SOYMON032	g2058504	BLASTN	62	1e-20	76
2403	1281	701046591H1	SOYMON032	g439493	BLASTN	59	1e-19	82
2404	1281	701098180H1	SOYMON028	g2058504	BLASTN	99	1e-17	57
2405	1281	701100412H1	SOYMON028	g2058504	BLASTN	103	1e-23	59
2406	1281	701102104H1	SOYMON028	g2058504	BLASTN	103	1e-23	59
2407	1281	701110419H1	SOYMON036	g439493	BLASTN	73	1e-22	73
2408	1281	701119007H1	SOYMON037	g439493	BLASTN	77	1e-21	73
2409	1281	701125666H1	SOYMON037	g439493	BLASTN	74	1e-22	82
2410	1281	701127596H1	SOYMON037	g439493	BLASTN	74	1e-22	82
2411	1281	701129476H1	SOYMON037	g439493	BLASTN	67	1e-21	71
2412	1281	701147394H1	SOYMON031	g2058504	BLASTN	103	1e-20	58
2413	1281	LIB3030-006-Q1-B1-D2	LIB3030	g2058504	BLASTN	103	1e-54	56
2414	1281	LIB3050-003-Q1-E1-D4	LIB3050	g2058504	BLASTN	103	1e-41	53
2415	1281	LIB3050-004-Q1-E1-B10	LIB3050	g439489	BLASTN	92	1e-35	69
2416	1281	LIB3051-004-Q1-E1-G9	LIB3051	g439493	BLASTN	74	1e-38	82
2417	1281	LIB3051-032-Q1-K1-H6	LIB3051	g439493	BLASTN	77	1e-46	70
2418	1281	LIB3051-095-Q1-K1-G3	LIB3051	g439493	BLASTN	104	1e-49	70
2419	13705	700851990H1	SOYMON023	g558542	BLASTN	1168	1e-88	99
2420	13705	700992111H1	SOYMON011	g558542	BLASTN	1058	1e-79	98
2421	13705	701139534H1	SOYMON038	g558542	BLASTN	874	1e-91	98
2422	13798	700563706H1	SOYMON002	g1786134	BLASTN	101	1e-20	63

2423	13798	700829518H1	SOYMON019	g1786134	BLASTN	148	1e-27	68
2424	13798	700829718H1	SOYMON019	g1786134	BLASTN	137	1e-25	72
2425	13798	701054893H1	SOYMON032	g1418335	BLASTN	163	1e-24	56
2426	14138	700686353H1	SOYMON008	g2340087	BLASTN	347	1e-18	71
2427	14138	700751440H1	SOYMON014	g2340087	BLASTN	311	1e-15	68
2428	14138	700867874H1	SOYMON016	g2340087	BLASTN	361	1e-19	66
2429	14138	700900614H1	SOYMON027	g2340087	BLASTN	318	1e-15	62
2430	14138	701010759H1	SOYMON019	g2340087	BLASTN	347	1e-18	71
2431	14138	701037317H1	SOYMON029	g2340087	BLASTN	386	1e-21	64
2432	14138	701038681H1	SOYMON029	g2340087	BLASTN	346	1e-18	71
2433	14138	LIB3065-002-Q1-N1-F7	LIB3065	g2340087	BLASTN	375	1e-21	66
2434	15560	700558649H1	SOYMON001	g1871192	BLASTN	147	1e-22	80
2435	16	LIB3049-020-Q1-E1-D1	LIB3049	g1800278	BLASTN	226	1e-08	58
2436	16	LIB3050-017-Q1-E1-F9	LIB3050	g790683	BLASTN	120	1e-35	59
2437	16	LIB3050-024-Q1-K1-B11	LIB3050	g790679	BLASTN	107	1e-34	60
2438	16	LIB3052-002-Q1-B1-A9	LIB3052	g1871192	BLASTN	125	1e-33	53
2439	16	LIB3039-012-Q1-E1-D8	LIB3039	g1871192	BLASTN	125	1e-41	68
2440	16	LIB3039-036-Q1-E1-E8	LIB3039	g1871192	BLASTN	139	1e-36	60
2441	16	LIB3039-022-Q1-E1-D10	LIB3039	g2961542	BLASTN	144	1e-38	65
2442	16	LIB3039-047-Q1-E1-G3	LIB3039	g1871192	BLASTN	111	1e-43	76
2443	17477	700846070H1	SOYMON021	g1800279	BLASTN	130	1e-20	95
2444	17477	700981868H1	SOYMON009	g1800279	BLASTN	253	1e-52	72
2445	18066	701122490H1	SOYMON037	g1418335	BLASTN	143	1e-25	68
2446	18242	700665667H1	SOYMON005	g2582643	BLASTN	126	1e-35	83
2447	18242	700834366H1	SOYMON019	g2582643	BLASTN	274	1e-50	79
2448	1880	700548213H1	SOYMON002	g1182006	BLASTN	668	1e-47	76
2449	1880	700560270H1	SOYMON001	g1182006	BLASTN	550	1e-37	78
2450	1880	700646501H1	SOYMON014	g1182006	BLASTN	632	1e-44	75
2451	1880	700655902H1	SOYMON004	g1182006	BLASTN	441	1e-27	75
2452	1880	700659785H1	SOYMON004	g1182006	BLASTN	579	1e-39	77
2453	1880	700660575H1	SOYMON004	g1182006	BLASTN	581	1e-39	76
2454	1880	700661543H1	SOYMON005	g1182006	BLASTN	690	1e-49	79
2455	1880	700662912H1	SOYMON005	g1182006	BLASTN	620	1e-43	76
2456	1880	700667516H1	SOYMON006	g1182006	BLASTN	490	1e-32	80
2457	1880	700740911H1	SOYMON012	g732811	BLASTN	174	1e-37	100
2458	1880	700744122H1	SOYMON013	g1182006	BLASTN	546	1e-36	75
2459	1880	700745185H1	SOYMON013	g732811	BLASTN	158	1e-43	91
2460	1880	700748385H1	SOYMON013	g1182006	BLASTN	566	1e-38	79
2461	1880	700754532H1	SOYMON014	g1182006	BLASTN	448	1e-28	66
2462	1880	700830859H1	SOYMON019	g1182006	BLASTN	572	1e-39	76
2463	1880	700853549H1	SOYMON023	g1182006	BLASTN	557	1e-37	79
2464	1880	700863521H1	SOYMON027	g1182006	BLASTN	499	1e-32	83
2465	1880	700960365H1	SOYMON022	g1182006	BLASTN	641	1e-45	76
2466	1880	700972326H1	SOYMON005	g1182006	BLASTN	621	1e-43	76
2467	1880	700973675H1	SOYMON005	g1182006	BLASTN	614	1e-42	76

2468	1880	700993904H1	SOYMON011	g1182006	BLASTN	371	1e-40	77
2469	1880	701007769H1	SOYMON019	g1182006	BLASTN	377	1e-21	83
2470	1880	701038517H1	SOYMON029	g1182006	BLASTN	678	1e-48	78
2471	1880	701041906H1	SOYMON029	g1182006	BLASTN	408	1e-23	81
2472	1880	701043891H1	SOYMON032	g732811	BLASTN	81	1e-39	75
2473	1880	701047838H1	SOYMON032	g1182006	BLASTN	520	1e-34	77
2474	1880	701047926H1	SOYMON032	g1182006	BLASTN	659	1e-46	76
2475	1880	701048273H1	SOYMON032	g1182006	BLASTN	550	1e-37	78
2476	1880	701050514H1	SOYMON032	g1182006	BLASTN	641	1e-45	78
2477	1880	701055331H1	SOYMON032	g1182006	BLASTN	568	1e-38	76
2478	1880	701055445H1	SOYMON032	g1182006	BLASTN	674	1e-47	75
2479	1880	701056851H1	SOYMON032	g1182006	BLASTN	599	1e-41	76
2480	1880	701061949H1	SOYMON033	g1182006	BLASTN	561	1e-50	80
2481	1880	701068587H1	SOYMON034	g1182006	BLASTN	649	1e-45	77
2482	1880	701098025H1	SOYMON028	g1182006	BLASTN	482	1e-40	78
2483	1880	701108025H1	SOYMON036	g1182006	BLASTN	602	1e-41	75
2484	1880	701124696H1	SOYMON037	g1182006	BLASTN	595	1e-41	75
2485	1880	701126996H1	SOYMON037	g1182006	BLASTN	377	1e-21	83
2486	1880	701139447H1	SOYMON038	g1182006	BLASTN	690	1e-49	75
2487	1880	701152229H1	SOYMON031	g732811	BLASTN	168	1e-37	84
2488	1880	701156733H1	SOYMON031	g1182006	BLASTN	435	1e-37	76
2489	1880	701204404H2	SOYMON035	g1182006	BLASTN	580	1e-39	79
2490	1880	701204619H1	SOYMON035	g1182006	BLASTN	527	1e-35	82
2491	1880	701207274H1	SOYMON035	g732811	BLASTN	72	1e-24	97
2492	1880	701212436H1	SOYMON035	g1182006	BLASTN	540	1e-36	75
2493	1880	701215258H1	SOYMON035	g1182006	BLASTN	509	1e-33	79
2494	1880	LIB3054-002-Q1-N1-E7	LIB3054	g1182006	BLASTN	636	1e-45	74
2495	1880	LIB3056-009-Q1-N1-A1	LIB3056	g1182006	BLASTN	720	1e-49	76
2496	1880	LIB3040-047-Q1-E1-A4	LIB3040	g1182006	BLASTN	711	1e-50	74
2497	1880	LIB3073-011-Q1-K1-G9	LIB3073	g1182006	BLASTN	692	1e-47	75
2498	1934	700730232H1	SOYMON009	g2708744	BLASTN	231	1e-33	65
2499	20802	700845749H1	SOYMON021	g1871192	BLASTN	85	1e-19	70
2500	20802	701205741H1	SOYMON035	g1800278	BLASTN	352	1e-18	66
2501	20802	701206823H1	SOYMON035	g1871192	BLASTN	238	1e-34	65
2502	20802	LIB3049-008-Q1-E1-D2	LIB3049	g1871192	BLASTN	303	1e-67	63
2503	20802	LIB3049-010-Q1-E1-C3	LIB3049	g2961541	BLASTN	490	1e-29	63
2504	20802	LIB3049-010-Q1-E1-H5	LIB3049	g2961541	BLASTN	480	1e-29	66
2505	22922	LIB3051-111-Q1-K1-D5	LIB3051	g1001957	BLASTN	85	1e-33	34
2506	23562	701005785H1	SOYMON019	g18819	BLASTN	126	1e-19	66
2507	23562	701126015H1	SOYMON037	g18819	BLASTN	139	1e-28	68
2508	23562	701140094H1	SOYMON038	g18819	BLASTN	133	1e-20	67
2509	23562	701148650H1	SOYMON031	g18819	BLASTN	213	1e-35	53
2510	24654	701005127H1	SOYMON019	g899254	BLASTN	165	1e-29	51
2511	24654	701047038H1	SOYMON032	g1052593	BLASTN	115	1e-17	60
2512	24862	701098039H1	SOYMON028	g2191172	BLASTN	139	1e-21	61
2513	24862	701209121H1	SOYMON035	g2191172	BLASTN	132	1e-20	54

2514	24981	700954134H1	SOYMON022	g1871192	BLASTN	129	1e-19	59
2515	24981	701202677H1	SOYMON035	g1871192	BLASTN	157	1e-23	62
2516	24981	701202728H1	SOYMON035	g1871192	BLASTN	224	1e-32	62
2517	24981	701205769H1	SOYMON035	g1871192	BLASTN	220	1e-32	64
2518	24981	LIB3049-046-Q1-E1-A5	LIB3049	g1800278	BLASTN	555	1e-50	72
2519	25044	701004822H1	SOYMON019	g1773040	BLASTN	154	1e-23	65
2520	25044	701048110H1	SOYMON032	g1773040	BLASTN	144	1e-22	66
2521	25044	701053310H1	SOYMON032	g1773040	BLASTN	154	1e-23	65
2522	25478	700897774H1	SOYMON027	g1872521	BLASTN	130	1e-20	70
2523	25478	701097643H1	SOYMON028	g1872521	BLASTN	172	1e-48	74
2524	25478	701118320H1	SOYMON037	g1872521	BLASTN	88	1e-31	67
2525	25478	LIB3051-019-Q1-E1-H6	LIB3051	g1872521	BLASTN	172	1e-83	71
2526	25478	LIB3051-112-Q1-K1-F11	LIB3051	g1872520	BLASTN	319	1e-33	74
2527	25641	700889154H1	SOYMON024	g1872521	BLASTN	206	1e-47	65
2528	25641	701123050H1	SOYMON037	g1872521	BLASTN	195	1e-52	73
2529	25641	701213617H1	SOYMON035	g1872521	BLASTN	168	1e-48	70
2530	27570	700763939H1	SOYMON019	g1418321	BLASTN	107	1e-22	74
2531	27570	701215156H1	SOYMON035	g1418321	BLASTN	112	1e-17	83
2532	27570	LIB3049-004-Q1-E1-C9	LIB3049	g1418321	BLASTN	107	1e-43	74
2533	27699	700973538H1	SOYMON005	g1871181	BLASTN	170	1e-25	49
2534	27699	701120758H1	SOYMON037	g1871181	BLASTN	148	1e-22	49
2535	27990	701061558H1	SOYMON033	g170624	BLASTN	139	1e-21	51
2536	27990	701202348H1	SOYMON035	g22046	BLASTN	151	1e-26	55
2537	29584	701120964H1	SOYMON037	g1871192	BLASTN	191	1e-28	91
2538	3051	700995972H1	SOYMON018	g2827537	BLASTN	170	1e-25	82
2539	30836	701005910H1	SOYMON019	g847869	BLASTN	75	1e-19	52
2540	30864	LIB3051-026-Q1-K1-B7	LIB3051	g3152598	BLASTN	198	1e-55	50
2541	30864	LIB3051-046-Q1-K1-E4	LIB3051	g3152598	BLASTN	250	1e-54	51
2542	3180	700975648H1	SOYMON009	g1871192	BLASTN	94	1e-23	56
2543	3193	700558715H1	SOYMON001	g1871192	BLASTN	243	1e-35	82
2544	3193	700562132H1	SOYMON002	g1871192	BLASTN	291	1e-42	83
2545	3193	700562292H1	SOYMON002	g1871192	BLASTN	341	1e-49	84
2546	3193	700564404H1	SOYMON002	g1871192	BLASTN	98	1e-23	81
2547	3193	700830515H1	SOYMON019	g1871192	BLASTN	197	1e-41	73
2548	3193	700842727H1	SOYMON020	g1871192	BLASTN	225	1e-36	82
2549	3193	700901732H1	SOYMON027	g1871192	BLASTN	182	1e-26	84
2550	3193	700992739H1	SOYMON011	g1871192	BLASTN	219	1e-32	82
2551	3193	LIB3055-013-Q1-N1-H2	LIB3055	g1871192	BLASTN	310	1e-64	76
2552	32309	700997523H1	SOYMON018	g558542	BLASTN	732	1e-89	94
2553	32309	701142559H1	SOYMON038	g558542	BLASTN	1043	1e-87	95
2554	32309	701209581H1	SOYMON035	g558542	BLASTN	1279	1e-97	99
2555	32309	LIB3051-075-Q1-K1-F1	LIB3051	g558542	BLASTN	1432	1e-147	90
2556	32379	700848828H1	SOYMON021	g790681	BLASTN	118	1e-22	74
2557	32379	LIB3050-011-Q1-E1-A8	LIB3050	g790683	BLASTN	159	1e-40	67
2558	32797	701152088H1	SOYMON031	g18819	BLASTN	129	1e-19	73



2559	32797	LIB3028-028-Q1-B1-F3	LIB3028	g18818	BLASTN	361	1e-39	76
2560	3362	700566936H1	SOYMON002	g1519680	BLASTN	130	1e-19	40
2561	3362	LIB3051-067-Q1-K1-C10	LIB3051	g1519680	BLASTN	93	1e-34	37
2562	33797	LIB3049-043-Q1-E1-D3	LIB3049	g1800278	BLASTN	461	1e-27	69
2563	33866	700900218H1	SOYMON027	g1872521	BLASTN	156	1e-43	65
2564	33877	700891618H1	SOYMON024	g1359492	BLASTN	475	1e-30	84
2565	33877	701133410H1	SOYMON038	g1359492	BLASTN	640	1e-44	80
2566	33877	LIB3049-006-Q1-E1-E5	LIB3049	g1359492	BLASTN	520	1e-32	83
2567	3605	700889233H1	SOYMON024	g558542	BLASTN	1106	1e-85	98
2568	3605	700957362H1	SOYMON022	g558542	BLASTN	1226	1e-93	98
2569	3726	700894655H1	SOYMON024	g170626	BLASTN	118	1e-18	41
2570	3726	700953353H1	SOYMON022	g170626	BLASTN	117	1e-18	41
2571	3765	700889620H1	SOYMON024	g18818	BLASTN	478	1e-31	76
2572	3765	700892932H1	SOYMON024	g18819	BLASTN	230	1e-35	57
2573	3765	700945128H1	SOYMON024	g18818	BLASTN	371	1e-20	78
2574	3960	LIB3051-092-Q1-K1-D6	LIB3051	g1871192	BLASTN	139	1e-36	53
2575	4005	700751479H1	SOYMON014	g18819	BLASTN	205	1e-32	69
2576	4005	700900939H1	SOYMON027	g18819	BLASTN	123	1e-19	84
2577	4005	700983734H1	SOYMON009	g18818	BLASTN	446	1e-26	73
2578	43	700661433H1	SOYMON005	g2582644	BLASTN	492	1e-37	76
2579	43	700665940H1	SOYMON005	g2582644	BLASTN	500	1e-32	69
2580	43	700679313H1	SOYMON007	g2582645	BLASTN	140	1e-21	75
2581	43	700679621H1	SOYMON007	g2582644	BLASTN	608	1e-41	76
2582	43	700732987H1	SOYMON010	g2582644	BLASTN	617	1e-42	77
2583	43	700745396H1	SOYMON013	g2582644	BLASTN	643	1e-44	73
2584	43	700786767H2	SOYMON011	g2582644	BLASTN	496	1e-32	74
2585	43	700832956H1	SOYMON019	g2582644	BLASTN	576	1e-39	74
2586	43	700833090H1	SOYMON019	g2582645	BLASTN	119	1e-46	82
2587	43	700852690H1	SOYMON023	g2582644	BLASTN	615	1e-42	77
2588	43	700871613H1	SOYMON018	g2582644	BLASTN	553	1e-37	75
2589	43	700895424H1	SOYMON027	g2582644	BLASTN	599	1e-45	76
2590	43	700898842H1	SOYMON027	g2582644	BLASTN	651	1e-45	77
2591	43	700952338H1	SOYMON022	g2582644	BLASTN	517	1e-34	74
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2619	43	701206931H1	SOYMON035	g2582644	BLASTN	651	1e-45	77
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2621	43	LIB3049-038-Q1-E1-G12	LIB3049	g2582642	BLASTN	452	1e-26	73
2622	43	LIB3049-034-Q1-E1-E9	LIB3049	g2582642	BLASTN	694	1e-66	73
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2631	4533	700657428H1	SOYMON004	g18819	BLASTN	174	1e-38	77
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2636	456	700671202H1	SOYMON006	g2827537	BLASTN	204	1e-33	67
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2638	4711	700863735H1	SOYMON016	g1871181	BLASTN	165	1e-24	62
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2662	6457	700649024H1	SOYMON003	g1773040	BLASTN	169	1e-25	67
2663	6457	700673477H1	SOYMON006	g1773040	BLASTN	175	1e-26	58
2664	6457	LIB3051-002-Q1-E1-E5	LIB3051	g3152606	BLASTN	273	1e-56	91
2665	6908	700751128H1	SOYMON014	g170216	BLASTN	905	1e-67	87
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2667	6908	700954358H1	SOYMON022	g170216	BLASTN	689	1e-48	86
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2676	8668	700898523H1	SOYMON027	g1871192	BLASTN	82	1e-20	55
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2678	8847	700846721H1	SOYMON021	g1872521	BLASTN	120	1e-26	58
2679	8847	701067278H1	SOYMON034	g1872521	BLASTN	91	1e-22	60
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2682	9230	700904566H1	SOYMON022	g1871192	BLASTN	115	1e-22	59
2683	9230	700951993H1	SOYMON022	g1871192	BLASTN	121	1e-27	64
2684	9230	700957717H1	SOYMON022	g1871192	BLASTN	93	1e-24	70
2685	9230	LIB3030-008-Q1-B1-G5	LIB3030	g1871192	BLASTN	115	1e-56	63
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SOYBEAN OTHER TRANSCRIPTION FACTORS

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2687	-700548142	700548142H1	SOYMON002	g19492	BLASTN	114	1e-30	61
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2689	-700554268	700554268H1	SOYMON001	g2398526	BLASTN	444	1e-26	79
2690	-700555970	700555970H1	SOYMON001	g286023	BLASTN	111	1e-20	47
2691	-700559531	700559531H1	SOYMON001	g1899058	BLASTN	130	1e-31	56
2692	-700563522	700563522H1	SOYMON002	g1100994	BLASTN	76	1e-18	48
2693	-700565384	700565384H1	SOYMON002	g1905944	BLASTN	85	1e-20	42
2694	-700565626	700565626H1	SOYMON002	g1732246	BLASTN	433	1e-40	78
2695	-700649584	700649584H1	SOYMON003	g2832408	BLASTN	88	1e-19	81

2696	-700650943	700650943H1	SOYMON003	g2062174	BLASTN	181	1e-27	65
2697	-700650945	700650945H1	SOYMON003	g2245059	BLASTN	240	1e-36	79
2698	-700651862	700651862H1	SOYMON003	g1061146	BLASTN	74	1e-22	49
2699	-700653241	700653241H1	SOYMON003	g2104680	BLASTN	424	1e-30	80
2700	-700653418	700653418H1	SOYMON003	g2464855	BLASTN	198	1e-29	70
2701	-700654319	700654319H1	SOYMON004	g1002799	BLASTN	493	1e-32	70
2702	-700661747	700661747H1	SOYMON005	g1046277	BLASTN	580	1e-86	82
2703	-700661861	700661861H1	SOYMON005	g2072499	BLASTN	167	1e-39	53
2704	-700662360	700662360H1	SOYMON005	g2244754	BLASTN	126	1e-22	51
2705	-700663241	700663241H1	SOYMON005	g2104680	BLASTN	257	1e-30	75
2706	-700664220	700664220H1	SOYMON005	g1747310	BLASTN	240	1e-34	52
2707	-700664496	700664496H1	SOYMON005	g289614	BLASTN	54	1e-17	44
2708	-700664802	700664802H1	SOYMON005	g2145357	BLASTN	294	1e-20	84
2709	-700668632	700668632H1	SOYMON006	g2104681	BLASTN	101	1e-24	65
2710	-700669003	700669003H1	SOYMON006	g19260	BLASTN	130	1e-23	54
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2723	-700725359	700725359H1	SOYMON009	g1183866	BLASTN	99	1e-24	70
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2732	-700738341	700738341H1	SOYMON012	g1049022	BLASTN	145	1e-22	58
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2734	-700739430	700739430H1	SOYMON012	g20565	BLASTN	104	1e-19	64
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2736	-700743470	700743470H1	SOYMON012	g2245390	BLASTN	150	1e-22	55
2737	-700745141	700745141H1	SOYMON013	g19380	BLASTN	133	1e-20	77
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2739	-700749192	700749192H1	SOYMON013	g2443887	BLASTN	142	1e-22	53
2740	-700749569	700749569H1	SOYMON013	g2398523	BLASTN	59	1e-18	52
2741	-700750838	700750838H1	SOYMON014	g1899057	BLASTN	524	1e-34	74
2742	-700753037	700753037H1	SOYMON014	g1100209	BLASTN	86	1e-24	55
2743	-700754169	700754169H1	SOYMON014	g1046275	BLASTN	528	1e-35	84
2744	-700757271	700757271H1	SOYMON015	g2443887	BLASTN	307	1e-44	70
2745	-700757675	700757675H1	SOYMON015	g2196466	BLASTN	79	1e-24	59
2746	-700759634	700759634H1	SOYMON015	g2511745	BLASTN	182	1e-26	52
2747	-700760424	700760424H1	SOYMON015	g662923	BLASTN	917	1e-83	89
2748	-700763862	700763862H1	SOYMON018	g2245390	BLASTN	144	1e-37	47
2749	-700764012	700764012H1	SOYMON019	g1167485	BLASTN	636	1e-63	79

2750	-700764321	700764321H1	SOYMON021	g2062174	BLASTN	79	1e-20	66
2751	-700787754	700787754H2	SOYMON011	g1495708	BLASTN	106	1e-18	45
2752	-700789356	700789356H2	SOYMON011	g437326	BLASTN	383	1e-50	79
2753	-700793581	700793581H1	SOYMON017	g1749546	BLASTN	257	1e-37	72
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2760	-700797333	700797333H1	SOYMON017	g22379	BLASTN	230	1e-26	81
2761	-700797418	700797418H1	SOYMON017	g22380	BLASTN	154	1e-23	91
2762	-700797911	700797911H1	SOYMON017	g662929	BLASTN	968	1e-89	97
2763	-700807587	700807587H1	SOYMON016	g662925	BLASTN	1676	1e-131	99
2764	-700833091	700833091H1	SOYMON019	g2104681	BLASTN	88	1e-19	78
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2767	-700835610	700835610H1	SOYMON019	g862650	BLASTN	109	1e-31	64
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2769	-700836749	700836749H1	SOYMON020	g2511745	BLASTN	134	1e-20	33
2770	-700836955	700836955H1	SOYMON020	g1046277	BLASTN	1135	1e-85	96
2771	-700840862	700840862H1	SOYMON020	g2832326	BLASTN	60	1e-18	70
2772	-700846675	700846675H1	SOYMON021	g791053	BLASTN	135	1e-21	56
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2774	-700847154	700847154H1	SOYMON021	g2398523	BLASTN	134	1e-20	85
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2776	-700850388	700850388H1	SOYMON023	g1046277	BLASTN	421	1e-48	82
2777	-700852080	700852080H1	SOYMON023	g2145358	BLASTN	176	1e-37	77
2778	-700852477	700852477H1	SOYMON023	g19490	BLASTN	140	1e-20	71
2779	-700854246	700854246H1	SOYMON023	g2398532	BLASTN	453	1e-29	75
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2782	-700865237	700865237H1	SOYMON016	g217859	BLASTN	145	1e-31	48
2783	-700867051	700867051H1	SOYMON016	g1019924	BLASTN	645	1e-44	74
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2787	-700870829	700870829H1	SOYMON018	g1532133	BLASTN	119	1e-18	59
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2789	-700872727	700872727H1	SOYMON018	g2443887	BLASTN	299	1e-43	69
2790	-700872828	700872828H1	SOYMON018	g19260	BLASTN	102	1e-25	70
2791	-700872947	700872947H1	SOYMON018	g19260	BLASTN	138	1e-20	86
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2798	-700889004	700889004H1	SOYMON024	g19380	BLASTN	135	1e-20	96
2799	-700890148	700890148H1	SOYMON024	g1747309	BLASTN	643	1e-44	72
2800	-700890210	700890210H1	SOYMON024	g1167485	BLASTN	575	1e-39	86
2801	-700891367	700891367H1	SOYMON024	g1747309	BLASTN	612	1e-42	78
2802	-700892430	700892430H1	SOYMON024	g19492	BLASTN	162	1e-24	67
2803	-700894470	700894470H1	SOYMON024	g22379	BLASTN	480	1e-31	79

2804	-700894554	700894554H1	SOYMON024	g2104678	BLASTN	961	1e-71	90
2805	-700896693	700896693H1	SOYMON027	g19057	BLASTN	179	1e-33	57
2806	-700896705	700896705H1	SOYMON027	g1370139	BLASTN	518	1e-34	67
2807	-700898269	700898269H1	SOYMON027	g1483231	BLASTN	805	1e-58	80
2808	-700900418	700900418H1	SOYMON027	g1763062	BLASTN	928	1e-86	84
2809	-700905160	700905160H1	SOYMON022	g2245134	BLASTN	136	1e-20	89
2810	-700906096	700906096H1	SOYMON022	g1483227	BLASTN	929	1e-68	83
2811	-700906279	700906279H1	SOYMON022	g2088641	BLASTN	218	1e-31	72
2812	-700907612	700907612H1	SOYMON022	g20563	BLASTN	156	1e-23	70
2813	-700907805	700907805H1	SOYMON022	g2832407	BLASTN	518	1e-34	74
2814	-700907885	700907885H1	SOYMON022	g1049023	BLASTN	420	1e-26	85
2815	-700907958	700907958H1	SOYMON022	g2443887	BLASTN	148	1e-22	58
2816	-700941440	700941440H1	SOYMON024	g19490	BLASTN	108	1e-24	50
2817	-700942877	700942877H1	SOYMON024	g437326	BLASTN	518	1e-34	71
2818	-700944108	700944108H1	SOYMON024	g662928	BLASTN	164	1e-25	81
2819	-700944823	700944823H1	SOYMON024	g1167486	BLASTN	70	1e-17	54
2820	-700944875	700944875H1	SOYMON024	g556408	BLASTN	323	1e-16	70
2821	-700944913	700944913H1	SOYMON024	g556558	BLASTN	223	1e-34	82
2822	-700952303	700952303H1	SOYMON022	g556557	BLASTN	904	1e-66	81
2823	-700952476	700952476H1	SOYMON022	g20563	BLASTN	147	1e-32	62
2824	-700953271	700953271H1	SOYMON022	g2702280	BLASTN	106	1e-23	53
2825	-700955669	700955669H1	SOYMON022	g2459835	BLASTN	102	1e-17	95
2826	-700955837	700955837H1	SOYMON022	g1002796	BLASTN	156	1e-25	71
2827	-700956059	700956059H1	SOYMON022	g1206002	BLASTN	294	1e-27	86
2828	-700956492	700956492H1	SOYMON022	g1239962	BLASTN	317	1e-16	83
2829	-700956972	700956972H1	SOYMON022	g2245632	BLASTN	122	1e-18	41
2830	-700957110	700957110H1	SOYMON022	g2196466	BLASTN	127	1e-22	71
2831	-700957658	700957658H1	SOYMON022	g1841474	BLASTN	666	1e-46	79
2832	-700958205	700958205H1	SOYMON022	g2245390	BLASTN	119	1e-18	76
2833	-700960143	700960143H1	SOYMON022	g1841475	BLASTN	89	1e-25	70
2834	-700962504	700962504H1	SOYMON022	g1749546	BLASTN	97	1e-25	54
2835	-700963673	700963673H1	SOYMON022	g1239963	BLASTN	119	1e-18	82
2836	-700964295	700964295H1	SOYMON022	g1420924	BLASTN	72	1e-17	51
2837	-700968421	700968421H1	SOYMON036	g945087	BLASTN	142	1e-21	89
2838	-700970839	700970839H1	SOYMON005	g1109828	BLASTN	117	1e-18	45
2839	-700971221	700971221H1	SOYMON005	g2832543	BLASTN	289	1e-23	81
2840	-700971962	700971962H1	SOYMON005	g16428	BLASTN	378	1e-20	73
2841	-700972493	700972493H1	SOYMON005	g2564336	BLASTN	787	1e-56	80
2842	-700972691	700972691H1	SOYMON005	g1890351	BLASTN	383	1e-39	78
2843	-700973132	700973132H1	SOYMON005	g2245390	BLASTN	116	1e-28	63
2844	-700973922	700973922H1	SOYMON005	g786426	BLASTN	65	1e-18	49
2845	-700974916	700974916H1	SOYMON005	g928930	BLASTN	76	1e-27	55
2846	-700976496	700976496H1	SOYMON009	g662931	BLASTN	435	1e-59	88
2847	-700977203	700977203H1	SOYMON009	g1239962	BLASTN	253	1e-10	81
2848	-700978443	700978443H1	SOYMON009	g662926	BLASTN	894	1e-73	94
2849	-700979531	700979531H2	SOYMON009	g1239961	BLASTN	84	1e-20	54
2850	-700979865	700979865H2	SOYMON009	g662926	BLASTN	955	1e-91	99
2851	-700981106	700981106H1	SOYMON009	g2245390	BLASTN	148	1e-22	37
2852	-700981889	700981889H1	SOYMON009	g928942	BLASTN	170	1e-29	68
2853	-700983448	700983448H1	SOYMON009	g2104678	BLASTN	583	1e-81	90
2854	-700983754	700983754H1	SOYMON009	g556557	BLASTN	260	1e-10	67
2855	-700985623	700985623H1	SOYMON009	g1167486	BLASTN	144	1e-21	77
2856	-700985923	700985923H1	SOYMON009	g1430845	BLASTN	660	1e-58	81
2857	-700986140	700986140H1	SOYMON009	g2443887	BLASTN	289	1e-41	69

2858	-700986876	700986876H1	SOYMON009	g662926	BLASTN	715	1e-90	94
2859	-700991054	700991054H1	SOYMON011	g2505876	BLASTN	125	1e-21	82
2860	-700992837	700992837H1	SOYMON011	g556557	BLASTN	503	1e-33	82
2861	-700993724	700993724H1	SOYMON011	g2564336	BLASTN	933	1e-68	85
2862	-700994373	700994373H1	SOYMON011	g2735765	BLASTN	509	1e-33	74
2863	-700995761	700995761H1	SOYMON011	g2564336	BLASTN	719	1e-56	81
2864	-700998422	700998422H1	SOYMON018	g2702280	BLASTN	157	1e-31	56
2865	-701000406	701000406H1	SOYMON018	g1430845	BLASTN	827	1e-60	84
2866	-701000444	701000444H1	SOYMON018	g1173615	BLASTN	738	1e-52	78
2867	-701000607	701000607H1	SOYMON018	g2398525	BLASTN	198	1e-31	63
2868	-701001157	701001157H1	SOYMON018	g2398526	BLASTN	484	1e-39	76
2869	-701001268	701001268H1	SOYMON018	g2104687	BLASTN	114	1e-17	50
2870	-701001671	701001671H1	SOYMON018	g437326	BLASTN	496	1e-32	84
2871	-701001986	701001986H1	SOYMON018	g1146237	BLASTN	106	1e-18	45
2872	-701002116	701002116H1	SOYMON018	g1049023	BLASTN	382	1e-27	77
2873	-701005343	701005343H1	SOYMON019	g928928	BLASTN	198	1e-29	82
2874	-701007423	701007423H2	SOYMON019	g2832407	BLASTN	391	1e-32	76
2875	-701009414	701009414H1	SOYMON019	g928928	BLASTN	183	1e-27	88
2876	-701010777	701010777H1	SOYMON019	g2443887	BLASTN	180	1e-31	82
2877	-701014349	701014349H1	SOYMON019	g862649	BLASTN	501	1e-31	74
2878	-701014944	701014944H1	SOYMON019	g2245389	BLASTN	307	1e-14	74
2879	-701038792	701038792H1	SOYMON029	g2827708	BLASTN	140	1e-21	92
2880	-701038959	701038959H1	SOYMON029	g662931	BLASTN	505	1e-80	96
2881	-701040606	701040606H1	SOYMON029	g1732513	BLASTN	130	1e-28	66
2882	-701042603	701042603H1	SOYMON029	g2104678	BLASTN	1215	1e-92	96
2883	-701044385	701044385H1	SOYMON032	g1101769	BLASTN	485	1e-31	70
2884	-701046304	701046304H1	SOYMON032	g1747309	BLASTN	241	1e-09	66
2885	-701048469	701048469H1	SOYMON032	g945086	BLASTN	473	1e-30	97
2886	-701052317	701052317H1	SOYMON032	g1101769	BLASTN	432	1e-25	75
2887	-701053807	701053807H1	SOYMON032	g1171428	BLASTN	688	1e-48	73
2888	-701054423	701054423H1	SOYMON032	g1617325	BLASTN	85	1e-19	65
2889	-701054948	701054948H1	SOYMON032	g19051	BLASTN	97	1e-20	67
2890	-701055890	701055890H1	SOYMON032	g2398526	BLASTN	429	1e-25	78
2891	-701056060	701056060H1	SOYMON032	g2398530	BLASTN	480	1e-31	76
2892	-701056537	701056537H1	SOYMON032	g2104678	BLASTN	736	1e-72	91
2893	-701059373	701059373H1	SOYMON033	g1420924	BLASTN	302	1e-43	63
2894	-701059890	701059890H1	SOYMON033	g1199574	BLASTN	611	1e-42	73
2895	-701060607	701060607H1	SOYMON033	g19260	BLASTN	149	1e-22	81
2896	-701062233	701062233H1	SOYMON033	g2673911	BLASTN	206	1e-30	66
2897	-701066326	701066326H1	SOYMON034	g1430846	BLASTN	246	1e-36	72
2898	-701067440	701067440H1	SOYMON034	g1890352	BLASTN	88	1e-28	63
2899	-701068223	701068223H1	SOYMON034	g437326	BLASTN	636	1e-44	75
2900	-701068964	701068964H1	SOYMON034	g1850792	BLASTN	496	1e-31	82
2901	-701096947	701096947H1	SOYMON028	g945086	BLASTN	276	1e-52	91
2902	-701098982	701098982H1	SOYMON028	g556557	BLASTN	435	1e-50	81
2903	-701099463	701099463H1	SOYMON028	g662929	BLASTN	240	1e-09	86
2904	-701099874	701099874H1	SOYMON028	g1763062	BLASTN	586	1e-67	98
2905	-701100471	701100471H1	SOYMON028	g1763062	BLASTN	1176	1e-89	93
2906	-701100647	701100647H1	SOYMON028	g1732513	BLASTN	136	1e-34	70
2907	-701101675	701101675H1	SOYMON028	g1931638	BLASTN	224	1e-32	65
2908	-701102484	701102484H1	SOYMON028	g662929	BLASTN	410	1e-61	87
2909	-701102774	701102774H1	SOYMON028	g431907	BLASTN	489	1e-44	80
2910	-701102848	701102848H1	SOYMON028	g19260	BLASTN	123	1e-18	59
2911	-701102963	701102963H1	SOYMON028	g1899057	BLASTN	218	1e-18	67



2912	-701103246	701103246H1	SOYMON028	g662929	BLASTN	286	1e-16	79
2913	-701106671	701106671H1	SOYMON036	g214598	BLASTN	124	1e-19	46
2914	-701106818	701106818H1	SOYMON036	g20562	BLASTN	517	1e-34	73
2915	-701108616	701108616H1	SOYMON036	g431907	BLASTN	577	1e-39	79
2916	-701109042	701109042H1	SOYMON036	g1430847	BLASTN	440	1e-26	83
2917	-701117735	701117735H2	SOYMON037	g662929	BLASTN	778	1e-89	93
2918	-701118607	701118607H1	SOYMON037	g2088641	BLASTN	251	1e-36	72
2919	-701120037	701120037H1	SOYMON037	g1171428	BLASTN	489	1e-62	76
2920	-701120442	701120442H1	SOYMON037	g330854	BLASTN	83	1e-17	41
2921	-701121085	701121085H1	SOYMON037	g2832499	BLASTN	251	1e-12	76
2922	-701121336	701121336H1	SOYMON037	g1763063	BLASTN	98	1e-18	65
2923	-701122944	701122944H1	SOYMON037	g2088641	BLASTN	111	1e-33	66
2924	-701123350	701123350H1	SOYMON037	g1841475	BLASTN	135	1e-20	58
2925	-701123424	701123424H1	SOYMON037	g2564336	BLASTN	434	1e-29	78
2926	-701124935	701124935H1	SOYMON037	g1171429	BLASTN	180	1e-42	84
2927	-701129683	701129683H1	SOYMON037	g2145358	BLASTN	113	1e-19	76
2928	-701129720	701129720H1	SOYMON037	g1747309	BLASTN	304	1e-33	85
2929	-701130095	701130095H1	SOYMON037	g1666173	BLASTN	80	1e-21	94
2930	-701130517	701130517H1	SOYMON038	g20563	BLASTN	105	1e-27	67
2931	-701132039	701132039H1	SOYMON038	g1747309	BLASTN	706	1e-49	76
2932	-701134320	701134320H1	SOYMON038	g1171428	BLASTN	735	1e-63	79
2933	-701135088	701135088H1	SOYMON038	g2398527	BLASTN	109	1e-22	69
2934	-701135953	701135953H1	SOYMON038	g1850792	BLASTN	354	1e-18	78
2935	-701137327	701137327H1	SOYMON038	g603404	BLASTN	81	1e-19	62
2936	-701137395	701137395H1	SOYMON038	g1171428	BLASTN	451	1e-49	78
2937	-701138849	701138849H1	SOYMON038	g1514441	BLASTN	309	1e-30	76
2938	-701138933	701138933H1	SOYMON038	g662931	BLASTN	475	1e-29	76
2939	-701139603	701139603H1	SOYMON038	g1171429	BLASTN	185	1e-27	82
2940	-701140084	701140084H1	SOYMON038	g1171428	BLASTN	714	1e-50	78
2941	-701147176	701147176H1	SOYMON031	g2463332	BLASTN	550	1e-37	75
2942	-701148988	701148988H1	SOYMON031	g1928873	BLASTN	564	1e-38	83
2943	-701150368	701150368H1	SOYMON031	g928927	BLASTN	549	1e-36	71
2944	-701202962	701202962H1	SOYMON035	g1747309	BLASTN	391	1e-37	78
2945	-701203226	701203226H1	SOYMON035	g20563	BLASTN	159	1e-45	94
2946	-701205743	701205743H1	SOYMON035	g2245390	BLASTN	125	1e-23	69
2947	-701206181	701206181H1	SOYMON035	g1429226	BLASTN	120	1e-18	66
2948	-701210138	701210138H1	SOYMON035	g1109830	BLASTN	95	1e-18	49
2949	-701211108	701211108H1	SOYMON035	g1666172	BLASTN	249	1e-26	70
2950	-701211345	701211345H1	SOYMON035	g2196466	BLASTN	188	1e-35	71
2951	-701212212	701212212H1	SOYMON035	g1181186	BLASTN	197	1e-29	57
2952	-701214026	701214026H1	SOYMON035	g1430845	BLASTN	581	1e-39	73
2953	-701214813	701214813H1	SOYMON035	g1046275	BLASTN	461	1e-28	79
2954	-701214851	701214851H1	SOYMON035	g2832407	BLASTN	683	1e-48	76
2955	10000	700905921H1	SOYMON022	g1617210	BLASTN	258	1e-10	85
2956	10000	701003915H1	SOYMON019	g19382	BLASTN	148	1e-22	93
2957	10171	700905319H1	SOYMON022	g1046275	BLASTN	486	1e-31	84
2958	10171	700908163H1	SOYMON022	g1046275	BLASTN	424	1e-26	84
2959	10171	700986903H1	SOYMON009	g1046275	BLASTN	324	1e-31	84
2960	10254	700737791H1	SOYMON012	g2505876	BLASTN	237	1e-36	86
2961	10254	700873059H1	SOYMON018	g2505876	BLASTN	249	1e-38	90
2962	10254	700874972H1	SOYMON018	g2505876	BLASTN	179	1e-27	88
2963	10254	700985967H1	SOYMON009	g2505876	BLASTN	194	1e-41	86
2964	10437	700840793H1	SOYMON020	g290056	BLASTN	573	1e-38	70
2965	10437	700895915H1	SOYMON027	g290056	BLASTN	458	1e-29	71

2966	10437	700982926H1	SOYMON009	g290056	BLASTN	627	1e-43	70
2967	10437	701060360H1	SOYMON033	g290056	BLASTN	688	1e-48	72
2968	10437	701131592H1	SOYMON038	g290056	BLASTN	410	1e-39	74
2969	10437	701144641H1	SOYMON031	g290056	BLASTN	585	1e-39	71
2970	10565	700991425H1	SOYMON011	g2702280	BLASTN	179	1e-26	62
2971	10565	701108083H1	SOYMON036	g2702280	BLASTN	151	1e-28	58
2972	10787	700671912H1	SOYMON006	g945086	BLASTN	559	1e-47	92
2973	10787	700758466H1	SOYMON015	g945086	BLASTN	876	1e-64	93
2974	10787	700892117H1	SOYMON024	g945086	BLASTN	443	1e-42	91
2975	10787	700896444H1	SOYMON027	g945086	BLASTN	947	1e-70	93
2976	10787	700944946H1	SOYMON024	g945086	BLASTN	899	1e-66	92
2977	10787	701210005H1	SOYMON035	g945086	BLASTN	774	1e-74	89
2978	10787	LIB3051-069-Q1-K1-A2	LIB3051	g945086	BLASTN	839	1e-78	88
2979	10864	700744919H1	SOYMON013	g662929	BLASTN	880	1e-64	83
2980	10864	700842507H1	SOYMON020	g662929	BLASTN	1050	1e-78	91
2981	10946	700654986H1	SOYMON004	g2104680	BLASTN	879	1e-64	81
2982	10946	700681111H2	SOYMON008	g2104680	BLASTN	430	1e-46	76
2983	1095	700748161H1	SOYMON013	g1370139	BLASTN	431	1e-25	78
2984	1095	700794538H1	SOYMON017	g1370139	BLASTN	444	1e-26	79
2985	1095	700868407H1	SOYMON016	g1370139	BLASTN	428	1e-25	76
2986	1095	700953788H1	SOYMON022	g20561	BLASTN	210	1e-31	85
2987	1095	700986049H1	SOYMON009	g1732247	BLASTN	158	1e-23	82
2988	1095	701051568H1	SOYMON032	g20560	BLASTN	514	1e-34	79
2989	1095	701123405H1	SOYMON037	g20560	BLASTN	509	1e-33	75
2990	1095	701123928H1	SOYMON037	g20560	BLASTN	611	1e-42	80
2991	1095	701146219H1	SOYMON031	g20561	BLASTN	132	1e-20	76
2992	1095	LIB3050-013-Q1-E1-B11	LIB3050	g20560	BLASTN	698	1e-47	77
2993	1095	LIB3050-026-Q1-K1-H10	LIB3050	g20560	BLASTN	835	1e-60	79
2994	1095	LIB3051-115-Q1-K1-C4	LIB3051	g20560	BLASTN	698	1e-48	79
2995	11055	700759318H1	SOYMON015	g19260	BLASTN	199	1e-29	88
2996	11055	701057861H1	SOYMON033	g19260	BLASTN	193	1e-28	85
2997	11147	700654617H1	SOYMON004	g2062176	BLASTN	108	1e-18	71
2998	11147	700895996H1	SOYMON027	g2062176	BLASTN	113	1e-19	81
2999	11250	700661815H1	SOYMON005	g386005	BLASTN	178	1e-33	57
3000	11328	LIB3051-115-Q1-K1-G1	LIB3051	g3183616	BLASTN	495	1e-30	73
3001	11544	700654919H1	SOYMON004	g786426	BLASTN	196	1e-29	62
3002	11544	700676985H1	SOYMON007	g786426	BLASTN	120	1e-23	67
3003	11544	700679185H1	SOYMON007	g786426	BLASTN	103	1e-26	73
3004	11544	700990491H1	SOYMON011	g786426	BLASTN	171	1e-28	74
3005	11544	701139368H1	SOYMON038	g786425	BLASTN	246	1e-09	66
3006	11544	LIB3051-101-Q1-K1-G3	LIB3051	g786425	BLASTN	415	1e-30	73
3007	11644	700671391H1	SOYMON006	g2464855	BLASTN	166	1e-25	77
3008	11644	700747110H1	SOYMON013	g217859	BLASTN	97	1e-22	70
3009	11644	700845340H1	SOYMON021	g2464855	BLASTN	120	1e-27	80
3010	11644	700957305H1	SOYMON022	g2464855	BLASTN	172	1e-25	76
3011	11644	701003021H1	SOYMON019	g2464855	BLASTN	172	1e-25	78
3012	11644	701127520H1	SOYMON037	g2464855	BLASTN	275	1e-40	85
3013	11644	701203752H2	SOYMON035	g2464855	BLASTN	133	1e-20	75

3014	11667	700653218H1	SOYMON003	g2505876	BLASTN	129	1e-21	73
3015	11667	700750602H1	SOYMON014	g2191140	BLASTN	131	1e-25	77
3016	11751	700942949H1	SOYMON024	g2398533	BLASTN	139	1e-21	90
3017	11851	700755115H1	SOYMON014	g945086	BLASTN	745	1e-53	100
3018	11851	701069677H1	SOYMON034	g945086	BLASTN	803	1e-58	97
3019	11851	701136069H1	SOYMON038	g945086	BLASTN	463	1e-56	94
3020	11900	700566352H1	SOYMON002	g862650	BLASTN	120	1e-21	94
3021	11900	700747814H1	SOYMON013	g862650	BLASTN	168	1e-25	94
3022	11955	700557413H1	SOYMON001	g1666172	BLASTN	851	1e-67	82
3023	11955	700663253H1	SOYMON005	g1666172	BLASTN	428	1e-26	79
3024	11955	700794214H1	SOYMON017	g1666172	BLASTN	755	1e-54	82
3025	11955	700830566H1	SOYMON019	g1666173	BLASTN	183	1e-39	71
3026	11955	700944006H1	SOYMON024	g1666172	BLASTN	650	1e-45	81
3027	11955	701004958H1	SOYMON019	g1666172	BLASTN	570	1e-42	82
3028	11955	701005066H1	SOYMON019	g1666172	BLASTN	726	1e-51	80
3029	11955	701069066H1	SOYMON034	g1666172	BLASTN	593	1e-53	81
3030	11955	701131007H1	SOYMON038	g1666172	BLASTN	863	1e-63	82
3031	11955	LIB3049-032-Q1-E1-D10	LIB3049	g1666172	BLASTN	451	1e-38	76
3032	12048	700566792H1	SOYMON002	g1946267	BLASTN	123	1e-34	62
3033	12048	700568511H1	SOYMON002	g1514441	BLASTN	452	1e-27	65
3034	12048	700831304H1	SOYMON019	g1946267	BLASTN	233	1e-34	65
3035	12048	700869181H1	SOYMON016	g1946267	BLASTN	131	1e-20	56
3036	12091	700845953H1	SOYMON021	g2145358	BLASTN	167	1e-24	67
3037	1230	700684237H1	SOYMON008	g2398523	BLASTN	126	1e-22	86
3038	1230	700844895H1	SOYMON021	g2398523	BLASTN	133	1e-20	85
3039	1236	LIB30451-020-Q1-E1-G2	LIB3051	g2398533	BLASTN	122	1e-34	85
3040	12388	700646372H1	SOYMON013	g662929	BLASTN	593	1e-47	85
3041	12388	701038095H1	SOYMON029	g662929	BLASTN	447	1e-43	78
3042	12388	701100361H1	SOYMON028	g662929	BLASTN	569	1e-45	89
3043	12388	701122795H1	SOYMON037	g662929	BLASTN	656	1e-58	89
3044	12498	700979878H2	SOYMON009	g662927	BLASTN	521	1e-34	99
3045	12498	701001033H1	SOYMON018	g662931	BLASTN	496	1e-31	74
3046	12498	701104992H1	SOYMON036	g2464881	BLASTN	155	1e-28	68
3047	12498	LIB3027-001-Q1-B1-H8	LIB3027	g2464881	BLASTN	151	1e-37	67
3048	12498	LIB3027-009-Q1-B1-B6	LIB3027	g1619921	BLASTN	167	1e-48	66
3049	12799	700956693H1	SOYMON022	g2145358	BLASTN	167	1e-33	73
3050	12804	700833812H1	SOYMON019	g662929	BLASTN	335	1e-17	84
3051	12804	700956487H1	SOYMON022	g662929	BLASTN	236	1e-09	84
3052	12804	701008918H1	SOYMON019	g662929	BLASTN	326	1e-16	82
3053	1281	701120916H1	SOYMON037	g1763063	BLASTN	71	1e-22	82
3054	13017	700972418H1	SOYMON005	g2505876	BLASTN	95	1e-19	68
3055	13126	700895010H1	SOYMON024	g662929	BLASTN	325	1e-16	83
3056	13126	701010473H1	SOYMON019	g662929	BLASTN	325	1e-16	83
3057	13126	701061469H1	SOYMON033	g662929	BLASTN	318	1e-15	82
3058	13165	700842617H1	SOYMON020	g671867	BLASTN	139	1e-28	83
3059	13165	700843378H1	SOYMON020	g671867	BLASTN	129	1e-19	73
3060	13389	700854414H1	SOYMON023	g1747310	BLASTN	202	1e-29	60
3061	13389	700959877H1	SOYMON022	g1747310	BLASTN	214	1e-30	51
3062	13392	700743260H1	SOYMON012	g1167484	BLASTN	148	1e-22	67
3063	13392	700831149H1	SOYMON019	g19050	BLASTN	722	1e-51	80

3064	13392	700835414H1	SOYMON019	g19050	BLASTN	704	1e-49	81
3065	13392	700851767H1	SOYMON023	g1167483	BLASTN	520	1e-34	83
3066	13392	700945055H1	SOYMON024	g1167483	BLASTN	445	1e-36	81
3067	13392	701055965H1	SOYMON032	g1167483	BLASTN	675	1e-53	80
3068	13392	701145654H1	SOYMON031	g1167483	BLASTN	534	1e-35	84
3069	13392	701151737H1	SOYMON031	g19050	BLASTN	810	1e-58	81
3070	13392	701156351H1	SOYMON031	g1167484	BLASTN	127	1e-24	86
3071	13392	701206635H1	SOYMON035	g19050	BLASTN	865	1e-63	82
3072	13392	701207519H1	SOYMON035	g1167483	BLASTN	525	1e-34	81
3073	13392	701211201H1	SOYMON035	g1167483	BLASTN	627	1e-43	73
3074	13392	LIB3028-011-Q1-B1-B6	LIB3028	g19050	BLASTN	933	1e-87	80
3075	13392	LIB3028-012-Q1-B1-D11	LIB3028	g19050	BLASTN	933	1e-83	80
3076	13447	700904560H1	SOYMON022	g2459835	BLASTN	83	1e-19	83
3077	13566	700554165H1	SOYMON001	g1899058	BLASTN	142	1e-21	69
3078	13566	700557146H1	SOYMON001	g1899058	BLASTN	128	1e-19	62
3079	13566	700754291H1	SOYMON014	g1899058	BLASTN	162	1e-24	65
3080	13796	700653244H1	SOYMON003	g2642435	BLASTN	268	1e-39	88
3081	13796	700835762H1	SOYMON019	g2464855	BLASTN	250	1e-59	86
3082	13796	700863608H1	SOYMON027	g2642435	BLASTN	255	1e-37	86
3083	13796	700895370H1	SOYMON027	g1263094	BLASTN	462	1e-28	70
3084	13796	700958710H1	SOYMON022	g2464855	BLASTN	174	1e-26	78
3085	13796	700978574H1	SOYMON009	g2642435	BLASTN	233	1e-34	87
3086	13796	701097113H1	SOYMON028	g2642435	BLASTN	253	1e-37	88
3087	13796	701120572H1	SOYMON037	g2642435	BLASTN	119	1e-18	79
3088	13823	700835395H1	SOYMON019	g1747309	BLASTN	268	1e-11	88
3089	13823	700900510H1	SOYMON027	g1747310	BLASTN	140	1e-21	100
3090	13927	701043135H1	SOYMON029	g1049022	BLASTN	123	1e-19	86
3091	14042	700954715H1	SOYMON022	g2088643	BLASTN	186	1e-28	66
3092	14042	700958105H1	SOYMON022	g2088643	BLASTN	186	1e-28	66
3093	1426	700677935H1	SOYMON007	g1239962	BLASTN	771	1e-55	88
3094	1426	700964919H1	SOYMON022	g1239958	BLASTN	919	1e-67	87
3095	1426	700967431H1	SOYMON031	g1239962	BLASTN	673	1e-47	87
3096	1426	700978693H1	SOYMON009	g1239958	BLASTN	863	1e-63	86
3097	1426	701204748H1	SOYMON035	g1239962	BLASTN	671	1e-47	88
3098	1426	701207929H1	SOYMON035	g1239962	BLASTN	789	1e-57	92
3099	1426	701212036H1	SOYMON035	g1239958	BLASTN	849	1e-62	88
3100	1426	701212768H1	SOYMON035	g1239962	BLASTN	537	1e-46	88
3101	1426	701212925H1	SOYMON035	g1239958	BLASTN	918	1e-67	86
3102	1426	701214971H1	SOYMON035	g1239962	BLASTN	847	1e-61	89
3103	1426	LIB3049-043-Q1-E1-A1	LIB3049	g3184053	BLASTN	641	1e-67	82
3104	1426	LIB3049-045-Q1-E1-A2	LIB3049	g1239958	BLASTN	1058	1e-79	77
3105	14645	700792802H1	SOYMON017	g2464855	BLASTN	247	1e-41	83
3106	14645	700953094H1	SOYMON022	g1263095	BLASTN	130	1e-22	86
3107	14752	700676408H1	SOYMON007	g2398529	BLASTN	229	1e-35	67
3108	14752	700678883H1	SOYMON007	g2398527	BLASTN	192	1e-30	64
3109	14752	LIB3040-002-Q1-E1-H9	LIB3040	g2244810	BLASTN	186	1e-47	67
3110	14752	LIB3040-043-Q1-E1-A2	LIB3040	g2398529	BLASTN	145	1e-49	58
3111	15006	700556101H1	SOYMON001	g1905943	BLASTN	502	1e-32	74

3112	15006	700756565H1	SOYMON014	g1905943	BLASTN	486	1e-30	73
3113	15006	701152347H1	SOYMON031	g886401	BLASTN	176	1e-30	68
3114	15006	701213371H1	SOYMON035	g2286108	BLASTN	415	1e-24	74
3115	15121	701151729H1	SOYMON031	g1850792	BLASTN	317	1e-15	76
3116	15282	700554959H1	SOYMON001	g662929	BLASTN	736	1e-92	90
3117	15282	700565494H1	SOYMON002	g662929	BLASTN	653	1e-48	97
3118	15282	700672958H1	SOYMON006	g662929	BLASTN	1138	1e-86	92
3119	15282	700841765H1	SOYMON020	g662929	BLASTN	1158	1e-87	98
3120	15282	700865782H1	SOYMON016	g662929	BLASTN	812	1e-58	91
3121	15282	701005796H1	SOYMON019	g662929	BLASTN	970	1e-87	94
3122	15282	701011751H1	SOYMON019	g662929	BLASTN	955	1e-84	96
3123	15282	701040773H1	SOYMON029	g662929	BLASTN	506	1e-53	95
3124	15282	701043485H1	SOYMON029	g662929	BLASTN	591	1e-84	93
3125	15282	701099256H1	SOYMON028	g662929	BLASTN	808	1e-58	90
3126	15282	701102707H1	SOYMON028	g662929	BLASTN	814	1e-81	92
3127	15282	701104821H1	SOYMON036	g662929	BLASTN	706	1e-52	73
3128	1529	700838292H1	SOYMON020	g1747310	BLASTN	188	1e-46	79
3129	15300	701099385H1	SOYMON028	g1732246	BLASTN	314	1e-15	81
3130	15300	701100720H1	SOYMON028	g20560	BLASTN	757	1e-54	77
3131	15300	701102079H1	SOYMON028	g1732246	BLASTN	552	1e-37	76
3132	15300	701102311H1	SOYMON028	g1732246	BLASTN	599	1e-41	81
3133	15300	LIB3050-017-Q1-E1-G2	LIB3050	g928967	BLASTN	190	1e-66	69
3134	15495	700675677H1	SOYMON007	g290054	BLASTN	499	1e-32	69
3135	15495	700973788H1	SOYMON005	g290054	BLASTN	568	1e-38	75
3136	15578	700564773H1	SOYMON002	g2832407	BLASTN	709	1e-50	78
3137	15578	700847403H1	SOYMON021	g2832408	BLASTN	162	1e-23	93
3138	15578	701063288H1	SOYMON033	g2832407	BLASTN	729	1e-52	80
3139	15587	700896212H1	SOYMON027	g1763063	BLASTN	104	1e-22	65
3140	15587	701005929H1	SOYMON019	g1763063	BLASTN	95	1e-19	60
3141	15621	700738572H1	SOYMON012	g556557	BLASTN	781	1e-56	80
3142	15621	700748295H1	SOYMON013	g556557	BLASTN	749	1e-53	76
3143	15621	700786689H1	SOYMON011	g556557	BLASTN	762	1e-54	78
3144	15621	700847602H1	SOYMON021	g556557	BLASTN	788	1e-56	80
3145	15621	700982068H1	SOYMON009	g556557	BLASTN	434	1e-38	70
3146	15621	701141959H1	SOYMON038	g556557	BLASTN	270	1e-38	76
3147	15621	701211323H1	SOYMON035	g556557	BLASTN	822	1e-59	80
3148	15621	LIB3051-041-Q1-K1-E7	LIB3051	g556557	BLASTN	1130	1e-85	75
3149	15621	LIB3051-050-Q1-K1-C1	LIB3051	g556557	BLASTN	1051	1e-87	71
3150	15636	700908666H1	SOYMON022	g786425	BLASTN	321	1e-16	74
3151	15636	701214806H1	SOYMON035	g786426	BLASTN	141	1e-21	65
3152	15750	701100857H1	SOYMON028	g1429226	BLASTN	123	1e-19	75
3153	15784	700977108H1	SOYMON009	g1430846	BLASTN	134	1e-26	76
3154	15814	700876181H1	SOYMON018	g1430845	BLASTN	379	1e-30	84
3155	15814	700904208H1	SOYMON022	g1430845	BLASTN	520	1e-34	85
3156	15949	701013357H1	SOYMON019	g2832499	BLASTN	281	1e-14	86
3157	16	700656362H1	SOYMON004	g1666172	BLASTN	562	1e-45	79
3158	16	700657269H1	SOYMON004	g1666172	BLASTN	714	1e-50	74
3159	16	700662937H1	SOYMON005	g1666172	BLASTN	807	1e-58	81
3160	16	700663027H1	SOYMON005	g1666172	BLASTN	860	1e-63	83
3161	16	700664156H1	SOYMON005	g1666172	BLASTN	681	1e-48	81
3162	16	700676039H1	SOYMON007	g862639	BLASTN	719	1e-51	84

3163	16	700678604H1	SOYMON007	g1666172	BLASTN	702	1e-61	80
3164	16	700725871H1	SOYMON009	g1666172	BLASTN	271	1e-11	78
3165	16	700727454H1	SOYMON009	g1666172	BLASTN	696	1e-49	82
3166	16	700736278H1	SOYMON010	g1666172	BLASTN	478	1e-31	82
3167	16	700736391H1	SOYMON010	g1666172	BLASTN	730	1e-52	83
3168	16	700745252H1	SOYMON013	g1666172	BLASTN	623	1e-43	76
3169	16	700751351H1	SOYMON014	g1666172	BLASTN	763	1e-55	82
3170	16	700751364H1	SOYMON014	g1666172	BLASTN	793	1e-57	83
3171	16	700756018H1	SOYMON014	g1666172	BLASTN	834	1e-61	83
3172	16	700757875H1	SOYMON015	g1666172	BLASTN	702	1e-57	80
3173	16	700761204H1	SOYMON015	g1666172	BLASTN	481	1e-44	82
3174	16	700786192H2	SOYMON011	g1666172	BLASTN	763	1e-55	82
3175	16	700790278H2	SOYMON011	g1666172	BLASTN	759	1e-54	84
3176	16	700830133H1	SOYMON019	g1666172	BLASTN	811	1e-59	82
3177	16	700834579H1	SOYMON019	g1666172	BLASTN	714	1e-50	83
3178	16	700835286H1	SOYMON019	g1666172	BLASTN	743	1e-53	84
3179	16	700835341H1	SOYMON019	g1666172	BLASTN	702	1e-49	83
3180	16	700837153H1	SOYMON020	g1666172	BLASTN	714	1e-50	83
3181	16	700841675H1	SOYMON020	g1666172	BLASTN	747	1e-53	84
3182	16	700841893H1	SOYMON020	g1666172	BLASTN	611	1e-42	82
3183	16	700845174H1	SOYMON021	g1666172	BLASTN	702	1e-49	83
3184	16	700845538H1	SOYMON021	g1666172	BLASTN	402	1e-54	81
3185	16	700850610H1	SOYMON023	g1666172	BLASTN	714	1e-50	83
3186	16	700852474H1	SOYMON023	g1666172	BLASTN	702	1e-49	83
3187	16	700856326H1	SOYMON023	g1666172	BLASTN	377	1e-45	81
3188	16	700888743H1	SOYMON024	g1666172	BLASTN	269	1e-31	74
3189	16	700893155H1	SOYMON024	g1666172	BLASTN	586	1e-47	79
3190	16	700898574H1	SOYMON027	g1666172	BLASTN	702	1e-49	79
3191	16	700901515H1	SOYMON027	g1666172	BLASTN	702	1e-54	80
3192	16	700942619H1	SOYMON024	g1666172	BLASTN	695	1e-58	79
3193	16	700963930H1	SOYMON022	g1666172	BLASTN	834	1e-61	83
3194	16	700967576H1	SOYMON032	g1666172	BLASTN	614	1e-42	82
3195	16	700968115H1	SOYMON035	g862640	BLASTN	163	1e-24	74
3196	16	700969563H1	SOYMON005	g1666172	BLASTN	689	1e-48	83
3197	16	700971156H1	SOYMON005	g1666172	BLASTN	702	1e-59	80
3198	16	700971170H1	SOYMON005	g1666172	BLASTN	702	1e-59	80
3199	16	700976536H1	SOYMON009	g1666172	BLASTN	260	1e-12	70
3200	16	700980472H1	SOYMON009	g602900	BLASTN	190	1e-31	92
3201	16	700985866H1	SOYMON009	g1666172	BLASTN	856	1e-62	81
3202	16	701003617H1	SOYMON019	g1666172	BLASTN	713	1e-56	80
3203	16	701038358H1	SOYMON029	g1666172	BLASTN	352	1e-20	83
3204	16	701043959H1	SOYMON032	g1666172	BLASTN	689	1e-51	80
3205	16	701045034H1	SOYMON032	g1666172	BLASTN	471	1e-30	82
3206	16	701045576H1	SOYMON032	g1666172	BLASTN	637	1e-44	82



3217	16	701061121H1	SOYMON033	g1666172	BLASTN	693	1e-49	81
3218	16	701067796H1	SOYMON034	g1666172	BLASTN	378	1e-22	83
3219	16	701068193H1	SOYMON034	g1666172	BLASTN	561	1e-47	80
3220	16	701068492H1	SOYMON034	g1666172	BLASTN	871	1e-64	83
3221	16	701069694H1	SOYMON034	g1666172	BLASTN	716	1e-51	83
3222	16	701103320H1	SOYMON028	g1666172	BLASTN	631	1e-43	82
3223	16	701120737H1	SOYMON037	g1666172	BLASTN	927	1e-68	83
3224	16	701129339H1	SOYMON037	g1666172	BLASTN	814	1e-59	82
3225	16	701133045H1	SOYMON038	g1666172	BLASTN	876	1e-64	83
3226	16	701138103H1	SOYMON038	g1666172	BLASTN	866	1e-63	81
3227	16	701143072H1	SOYMON038	g1666172	BLASTN	716	1e-51	83
3228	16	701204303H2	SOYMON035	g862639	BLASTN	737	1e-52	84
3229	16	701204608H1	SOYMON035	g1666172	BLASTN	702	1e-56	79
3230	16	701204922H1	SOYMON035	g862639	BLASTN	875	1e-64	79
3231	16	701205428H1	SOYMON035	g862639	BLASTN	650	1e-51	85
3232	16	701206347H1	SOYMON035	g1666172	BLASTN	927	1e-68	83
3233	16	701207820H1	SOYMON035	g862639	BLASTN	579	1e-39	81
3234	16	701209725H1	SOYMON035	g1666172	BLASTN	702	1e-61	80
3235	16	701209945H1	SOYMON035	g862639	BLASTN	495	1e-32	77
3236	16	701210002H1	SOYMON035	g1666172	BLASTN	670	1e-47	80
3237	16	701211050H1	SOYMON035	g862639	BLASTN	716	1e-50	84
3238	16	701211278H1	SOYMON035	g1666172	BLASTN	471	1e-30	82
3239	16	701214222H1	SOYMON035	g862639	BLASTN	746	1e-53	84
3240	16	LIB3049-008-Q1-E1-B2	LIB3049	g862639	BLASTN	864	1e-76	79
3241	16	LIB3049-025-Q1-E1-B6	LIB3049	g1666172	BLASTN	643	1e-46	79
3242	16	LIB3049-021-Q1-E1-E11	LIB3049	g862639	BLASTN	841	1e-70	78
3243	16	LIB3049-018-Q1-E1-C6	LIB3049	g1666172	BLASTN	427	1e-36	72
3244	16	LIB3049-016-Q1-E1-G1	LIB3049	g862639	BLASTN	1006	1e-75	80
3245	16	LIB3049-035-Q1-E1-C12	LIB3049	g2997614	BLASTN	511	1e-40	78
3246	16	LIB3049-040-Q1-E1-E6	LIB3049	g862639	BLASTN	963	1e-71	82
3247	16	LIB3049-030-Q1-E1-G12	LIB3049	g2997614	BLASTN	599	1e-40	83
3248	16	LIB3049-034-Q1-E1-B10	LIB3049	g2997614	BLASTN	1048	1e-78	79
3249	16	LIB3049-050-Q1-E1-B8	LIB3049	g862639	BLASTN	806	1e-58	84
3250	16	LIB3049-045-Q1-E1-A8	LIB3049	g862639	BLASTN	655	1e-65	78
3251	16	LIB3056-004-Q1-N1-B8	LIB3056	g1666172	BLASTN	495	1e-36	69
3252	16	LIB3040-010-Q1-E1-E11	LIB3040	g1666172	BLASTN	1026	1e-77	83
3253	16	LIB3040-010-Q1-E1-G10	LIB3040	g1619921	BLASTN	98	1e-35	47
3254	16	LIB3040-009-Q1-E1-H10	LIB3040	g1666172	BLASTN	944	1e-70	81
3255	16	LIB3040-017-	LIB3040	g1666172	BLASTN	1033	1e-77	83



3444	25580	701207013H1	SOYMON035	g1870205	BLASTN	615	1e-42	74
3445	25580	701209467H1	SOYMON035	g22666	BLASTN	567	1e-38	79
3446	25580	LIB3049-051-Q1-E1-H4	LIB3049	g1870205	BLASTN	642	1e-57	75
3447	25580	LIB3028-030-Q1-B1-G8	LIB3028	g1870205	BLASTN	640	1e-51	76
3448	25755	701049112H1	SOYMON032	g1429226	BLASTN	121	1e-18	76
3449	25854	701123518H1	SOYMON037	g2398532	BLASTN	790	1e-57	77
3450	26035	700993991H1	SOYMON011	g2505876	BLASTN	176	1e-26	66
3451	26035	701044819H1	SOYMON032	g2505876	BLASTN	170	1e-25	65
3452	26620	701156706H1	SOYMON031	g1206002	BLASTN	556	1e-37	70
3453	26620	701157007H1	SOYMON031	g1239960	BLASTN	437	1e-26	65
3454	26979	700853506H1	SOYMON023	g556557	BLASTN	640	1e-44	78
3455	26979	701052874H1	SOYMON032	g556557	BLASTN	911	1e-67	82
3456	27155	701210746H1	SOYMON035	g556408	BLASTN	280	1e-12	70
3457	27155	701211562H1	SOYMON035	g556408	BLASTN	314	1e-15	70
3458	27697	700677948H1	SOYMON007	g2398527	BLASTN	123	1e-22	65
3459	27697	701125758H1	SOYMON037	g22379	BLASTN	525	1e-43	73
3460	27778	700658844H1	SOYMON004	g2104680	BLASTN	772	1e-55	79
3461	27778	700787104H2	SOYMON011	g2104680	BLASTN	767	1e-60	80
3462	27778	701148053H1	SOYMON031	g2104680	BLASTN	772	1e-55	79
3463	27778	LIB3054-004-Q1-N1-H8	LIB3054	g2104680	BLASTN	1084	1e-81	82
3464	27778	LIB3050-006-Q1-E1-B4	LIB3050	g2104680	BLASTN	955	1e-73	77
3465	27977	700994095H1	SOYMON011	g556557	BLASTN	857	1e-62	82
3466	27977	701203544H2	SOYMON035	g556557	BLASTN	824	1e-59	81
3467	28017	700834026H1	SOYMON019	g2832407	BLASTN	677	1e-47	76
3468	28017	701004442H1	SOYMON019	g2832407	BLASTN	585	1e-39	76
3469	28100	701044845H1	SOYMON032	g1002800	BLASTN	147	1e-24	81
3470	28100	701102677H1	SOYMON028	g1002800	BLASTN	157	1e-23	81
3471	28161	701005049H1	SOYMON019	g662929	BLASTN	189	1e-13	73
3472	28161	701042306H1	SOYMON029	g662929	BLASTN	322	1e-16	68
3473	28204	700663342H1	SOYMON005	g1838976	BLASTN	131	1e-30	63
3474	28204	701122846H1	SOYMON037	g1838975	BLASTN	564	1e-38	74
3475	28204	701206602H1	SOYMON035	g1838976	BLASTN	130	1e-19	40
3476	28204	LIB3050-023-Q1-K1-H4	LIB3050	g1838975	BLASTN	748	1e-51	67
3477	28204	LIB3051-003-Q1-E1-G12	LIB3051	g1838975	BLASTN	680	1e-45	65
3478	28346	700671032H1	SOYMON006	g1171428	BLASTN	446	1e-26	78
3479	28438	LIB3049-003-Q1-E1-E8	LIB3049	g2245390	BLASTN	159	1e-41	87
3480	2879	700725235H1	SOYMON009	g1183866	BLASTN	176	1e-38	68
3481	2886	700959889H1	SOYMON022	g172637	BLASTN	240	1e-09	65
3482	291	700657232H1	SOYMON004	g2398527	BLASTN	93	1e-23	78
3483	291	700754192H1	SOYMON014	g22379	BLASTN	452	1e-35	82
3484	291	700899456H1	SOYMON027	g2398527	BLASTN	121	1e-19	92
3485	291	700969546H1	SOYMON005	g2398527	BLASTN	120	1e-24	78
3486	291	701064889H1	SOYMON034	g2398527	BLASTN	80	1e-22	75
3487	291	701122985H1	SOYMON037	g22379	BLASTN	494	1e-37	83
3488	291	701133572H2	SOYMON038	g22379	BLASTN	484	1e-37	81
3489	29481	700734814H1	SOYMON010	g1430847	BLASTN	642	1e-44	77
3490	29660	LIB3050-015-	LIB3050	g2464855	BLASTN	91	1e-44	78

		Q1-E1-H2						
3491	29660	LIB3053-001-Q1-B1-D9	LIB3053	g1263095	BLASTN	101	1e-44	59
3492	30057	LIB3049-041-Q1-E1-F9	LIB3049	g2920839	BLASTN	255	1e-55	51
3493	30591	700786351H1	SOYMON011	g2104680	BLASTN	225	1e-17	86
3494	30591	LIB3049-015-Q1-E1-C8	LIB3049	g2104680	BLASTN	324	1e-18	76
3495	30776	701132894H1	SOYMON038	g1430848	BLASTN	86	1e-22	75
3496	30776	LIB3051-072-Q1-K1-D1	LIB3051	g1430848	BLASTN	144	1e-42	73
3497	30802	700679829H1	SOYMON007	g1232130	BLASTN	159	1e-24	71
3498	30802	LIB3051-061-Q1-K1-D12	LIB3051	g1232130	BLASTN	159	1e-40	55
3499	31069	700731911H1	SOYMON010	g1181185	BLASTN	367	1e-44	78
3500	31069	LIB3028-002-Q1-B1-B2	LIB3028	g3184053	BLASTN	1421	1e-110	87
3501	31069	LIB3049-007-Q1-E1-E6	LIB3049	g3184053	BLASTN	817	1e-65	90
3502	31384	700651585H1	SOYMON003	g786426	BLASTN	161	1e-26	54
3503	31384	LIB3051-005-Q1-E1-G9	LIB3051	g786426	BLASTN	180	1e-42	55
3504	31476	700905514H1	SOYMON022	g433634	BLASTN	271	1e-11	67
3505	31476	LIB3051-042-Q1-K1-C7	LIB3051	g433634	BLASTN	271	1e-11	67
3506	3153	700560933H1	SOYMON001	g20562	BLASTN	1011	1e-75	84
3507	3153	701107472H1	SOYMON036	g20562	BLASTN	813	1e-58	83
3508	3153	701141189H1	SOYMON038	g20562	BLASTN	887	1e-65	82
3509	3153	701142353H1	SOYMON038	g20562	BLASTN	790	1e-60	80
3510	3156	700548233H1	SOYMON002	g662930	BLASTN	226	1e-33	69
3511	3156	700836407H1	SOYMON020	g662930	BLASTN	131	1e-20	67
3512	3156	700836443H1	SOYMON020	g2464881	BLASTN	131	1e-19	61
3513	3156	700852876H1	SOYMON023	g662930	BLASTN	176	1e-35	68
3514	3156	701134888H2	SOYMON038	g19488	BLASTN	219	1e-32	71
3515	31655	LIB3065-006-Q1-N1-D1	LIB3065	g2921333	BLASTN	649	1e-43	69
3516	31655	LIB3065-006-Q1-N1-F4	LIB3065	g2921333	BLASTN	651	1e-43	67
3517	31674	700896653H1	SOYMON027	g945086	BLASTN	1303	1e-100	98
3518	31674	LIB3051-030-Q1-K1-H12	LIB3051	g945086	BLASTN	1799	1e-153	94
3519	31973	701108371H1	SOYMON036	g662929	BLASTN	937	1e-79	95
3520	31973	LIB3049-048-Q1-E1-F11	LIB3049	g662929	BLASTN	1317	1e-105	78
3521	3229	700831738H1	SOYMON019	g1946267	BLASTN	260	1e-38	70
3522	3229	700870313H1	SOYMON016	g1946267	BLASTN	234	1e-34	72
3523	32348	LIB3051-045-Q1-K1-E8	LIB3051	g2104680	BLASTN	183	1e-11	77
3524	32814	700852749H1	SOYMON023	g556557	BLASTN	798	1e-57	80
3525	32814	LIB3049-002-Q1-E1-F12	LIB3049	g556557	BLASTN	1071	1e-80	77
3526	32958	700896355H1	SOYMON027	g1263095	BLASTN	92	1e-20	78
3527	32958	LIB3055-013-Q1-N1-G5	LIB3055	g1263095	BLASTN	99	1e-36	73

3528	33430	700670286H1	SOYMON006	g19260	BLASTN	145	1e-23	67
3529	33430	LIB3051-008-Q1-E1-A6	LIB3051	g19491	BLASTN	378	1e-31	64
3530	33452	700728414H1	SOYMON009	g2104680	BLASTN	643	1e-60	85
3531	33452	LIB3050-020-Q1-K1-D11	LIB3050	g2104680	BLASTN	805	1e-63	80
3532	33477	700894136H1	SOYMON024	g2702280	BLASTN	80	1e-21	52
3533	33477	LIB3051-083-Q1-K1-E1	LIB3051	g2702280	BLASTN	189	1e-58	49
3534	33485	701202635H1	SOYMON035	g1568512	BLASTN	472	1e-30	73
3535	33485	LIB3051-059-Q1-K2-E10	LIB3051	g1568512	BLASTN	503	1e-30	74
3536	3358	700558937H1	SOYMON001	g662929	BLASTN	1048	1e-78	98
3537	3358	700853374H1	SOYMON023	g662929	BLASTN	880	1e-84	98
3538	3366	700564935H1	SOYMON002	g1899058	BLASTN	104	1e-20	70
3539	3366	700750112H1	SOYMON013	g1899057	BLASTN	477	1e-30	65
3540	3366	700867871H1	SOYMON016	g1899058	BLASTN	115	1e-17	71
3541	3366	700897446H1	SOYMON027	g1899058	BLASTN	126	1e-19	72
3542	3366	701013517H1	SOYMON019	g1899058	BLASTN	194	1e-29	67
3543	3366	701128079H1	SOYMON037	g1899058	BLASTN	167	1e-25	60
3544	3366	LIB3056-001-Q1-B1-B4	LIB3056	g2980802	BLASTN	214	1e-47	62
3545	33681	701208255H1	SOYMON035	g786426	BLASTN	99	1e-19	83
3546	33681	LIB3051-067-Q1-K1-C1	LIB3051	g2062176	BLASTN	121	1e-50	56
3547	33852	701138263H1	SOYMON038	g1183866	BLASTN	197	1e-31	65
3548	33852	LIB3051-079-Q1-K1-B11	LIB3051	g1707009	BLASTN	245	1e-53	55
3549	3479	700558834H1	SOYMON001	g19260	BLASTN	119	1e-18	52
3550	3564	700661347H1	SOYMON005	g2104680	BLASTN	308	1e-14	80
3551	3564	700829613H1	SOYMON019	g2104680	BLASTN	235	1e-08	85
3552	3564	700850396H1	SOYMON023	g2104681	BLASTN	118	1e-18	88
3553	3564	700899102H1	SOYMON027	g2104681	BLASTN	114	1e-17	88
3554	3564	700905639H1	SOYMON022	g2104681	BLASTN	127	1e-19	89
3555	3564	700959049H1	SOYMON022	g2104680	BLASTN	235	1e-09	78
3556	3564	700973814H1	SOYMON005	g2104680	BLASTN	235	1e-09	88
3557	3564	700982810H1	SOYMON009	g2104680	BLASTN	234	1e-09	74
3558	3564	701001146H1	SOYMON018	g2104680	BLASTN	239	1e-09	74
3559	3564	701012290H1	SOYMON019	g2104681	BLASTN	114	1e-17	88
3560	3564	701013913H1	SOYMON019	g2104680	BLASTN	235	1e-08	85
3561	3564	701038255H1	SOYMON029	g2104680	BLASTN	235	1e-10	70
3562	3564	701038727H1	SOYMON029	g2104681	BLASTN	105	1e-22	89
3563	3564	701045377H1	SOYMON032	g2104680	BLASTN	228	1e-09	69
3564	3564	701064305H1	SOYMON034	g2104680	BLASTN	235	1e-08	85
3565	3564	701105787H1	SOYMON036	g2104680	BLASTN	235	1e-09	78
3566	3564	LIB3065-008-Q1-N1-G11	LIB3065	g2104680	BLASTN	308	1e-15	69
3567	3564	LIB3029-007-Q1-B1-G6	LIB3029	g2104681	BLASTN	118	1e-34	88
3568	3564	LIB3051-064-Q1-K1-H3	LIB3051	g2104681	BLASTN	118	1e-39	77
3569	3739	700678057H1	SOYMON007	g167727	BLASTN	217	1e-08	75
3570	3756	700750091H1	SOYMON013	g1838975	BLASTN	369	1e-20	74
3571	3756	700896732H1	SOYMON027	g1838975	BLASTN	365	1e-19	76

3572	3757	700906204H1	SOYMON022	g1945281	BLASTN	76	1e-18	49
3573	3757	LIB3040-025-Q1-E1-B10	LIB3040	g3183616	BLASTN	662	1e-44	72
3574	3757	LIB3040-058-Q1-E1-D7	LIB3040	g3183617	BLASTN	347	1e-66	78
3575	3757	LIB3039-014-Q1-E1-E11	LIB3039	g3183616	BLASTN	779	1e-55	72
3576	3840	701038289H1	SOYMON029	g1263094	BLASTN	494	1e-31	75
3577	3840	701212974H1	SOYMON035	g1263094	BLASTN	546	1e-36	74
3578	3840	LIB3051-018-Q1-E1-G6	LIB3051	g1263094	BLASTN	899	1e-66	75
3579	3911	700684011H1	SOYMON008	g1749546	BLASTN	121	1e-22	58
3580	3911	700726126H1	SOYMON009	g1749546	BLASTN	138	1e-20	60
3581	3911	700734215H1	SOYMON010	g1749546	BLASTN	105	1e-23	51
3582	3911	700996059H1	SOYMON018	g1749546	BLASTN	122	1e-18	58
3583	3911	701014452H1	SOYMON019	g1749546	BLASTN	140	1e-22	55
3584	3911	701056116H1	SOYMON032	g1749546	BLASTN	141	1e-22	60
3585	3911	701121214H1	SOYMON037	g1749546	BLASTN	122	1e-18	51
3586	3911	701132709H1	SOYMON038	g1749546	BLASTN	122	1e-22	56
3587	3911	LIB3049-052-Q1-E1-E7	LIB3049	g1749546	BLASTN	82	1e-35	60
3588	3926	700837867H1	SOYMON020	g1619921	BLASTN	144	1e-21	63
3589	3926	700842078H1	SOYMON020	g1619921	BLASTN	212	1e-30	64
3590	3926	700843027H1	SOYMON020	g19488	BLASTN	170	1e-31	76
3591	3926	700843129H1	SOYMON020	g662930	BLASTN	113	1e-20	70
3592	3926	700853331H1	SOYMON023	g19487	BLASTN	521	1e-34	73
3593	3926	700907314H1	SOYMON022	g1619921	BLASTN	153	1e-25	58
3594	3926	700907613H1	SOYMON022	g2464881	BLASTN	101	1e-20	56
3595	3926	700967747H1	SOYMON033	g662931	BLASTN	631	1e-43	73
3596	3926	701042075H1	SOYMON029	g662931	BLASTN	456	1e-28	70
3597	3926	LIB3049-034-Q1-E1-F3	LIB3049	g19488	BLASTN	161	1e-57	69
3598	3937	700658125H1	SOYMON004	g2104680	BLASTN	326	1e-25	80
3599	3937	700745125H1	SOYMON013	g2104680	BLASTN	330	1e-27	77
3600	3937	700748325H1	SOYMON013	g2104680	BLASTN	326	1e-22	81
3601	3937	700845251H1	SOYMON021	g2104681	BLASTN	102	1e-26	86
3602	3937	700851931H1	SOYMON023	g2104680	BLASTN	367	1e-21	73
3603	3937	700854081H1	SOYMON023	g2104680	BLASTN	542	1e-36	75
3604	3937	700944587H1	SOYMON024	g2104680	BLASTN	644	1e-44	82
3605	3937	LIB3049-006-Q1-E1-E8	LIB3049	g2104680	BLASTN	919	1e-73	80
3606	3937	LIB3053-002-Q1-B1-F2	LIB3053	g2104680	BLASTN	585	1e-62	78
3607	4122	700863730H1	SOYMON016	g2555018	BLASTN	108	1e-18	31
3608	419	700554553H1	SOYMON001	g556557	BLASTN	434	1e-25	81
3609	419	700562907H1	SOYMON002	g556557	BLASTN	915	1e-67	82
3610	419	700669631H1	SOYMON006	g556557	BLASTN	850	1e-62	83
3611	419	700669949H1	SOYMON006	g556557	BLASTN	850	1e-62	83
3612	419	700681868H1	SOYMON008	g556557	BLASTN	912	1e-67	85
3613	419	700684342H1	SOYMON008	g556557	BLASTN	656	1e-45	82
3614	419	700685678H1	SOYMON008	g556557	BLASTN	663	1e-46	82
3615	419	700758063H1	SOYMON015	g556557	BLASTN	922	1e-68	84
3616	419	700795941H1	SOYMON017	g556557	BLASTN	354	1e-54	82
3617	419	701044342H1	SOYMON032	g556557	BLASTN	672	1e-47	81

3618	419	701044487H1	SOYMON032	g556557	BLASTN	693	1e-48	83
3619	419	701118765H1	SOYMON037	g556557	BLASTN	959	1e-71	83
3620	419	LIB3051-047-Q1-K1-D7	LIB3051	g556557	BLASTN	1241	1e-94	82
3621	419	LIB3073-013-Q1-K1-D3	LIB3073	g556557	BLASTN	442	1e-25	82
3622	4212	701150507H1	SOYMON031	g1181264	BLASTN	235	1e-08	61
3623	4509	700835337H1	SOYMON019	g1763063	BLASTN	125	1e-22	93
3624	4509	700865469H1	SOYMON016	g1763063	BLASTN	171	1e-25	66
3625	4509	700906733H1	SOYMON022	g1763063	BLASTN	95	1e-22	89
3626	4509	701117825H2	SOYMON037	g1763063	BLASTN	147	1e-25	94
3627	4513	700833937H1	SOYMON019	g171854	BLASTN	118	1e-25	39
3628	4513	700863780H1	SOYMON016	g171854	BLASTN	127	1e-25	38
3629	4533	700730794H1	SOYMON009	g1850792	BLASTN	353	1e-39	81
3630	4533	700742725H1	SOYMON012	g1850792	BLASTN	305	1e-16	82
3631	4533	700749727H1	SOYMON013	g1850792	BLASTN	504	1e-59	84
3632	4533	700789503H2	SOYMON011	g1850792	BLASTN	355	1e-48	81
3633	4533	700848536H1	SOYMON021	g1850792	BLASTN	465	1e-29	84
3634	4533	700888137H1	SOYMON024	g1850792	BLASTN	327	1e-16	86
3635	4533	700889876H1	SOYMON024	g1850792	BLASTN	314	1e-15	84
3636	4533	700893009H1	SOYMON024	g1850792	BLASTN	504	1e-33	83
3637	4533	700944604H1	SOYMON024	g1850792	BLASTN	465	1e-29	80
3638	4533	700952210H1	SOYMON022	g1850792	BLASTN	507	1e-33	84
3639	4533	700955405H1	SOYMON022	g1850792	BLASTN	507	1e-33	84
3640	4533	700956625H1	SOYMON022	g1850792	BLASTN	399	1e-22	83
3641	4533	701004730H1	SOYMON019	g1850792	BLASTN	507	1e-33	84
3642	4533	701004762H1	SOYMON019	g1850792	BLASTN	500	1e-32	83
3643	4533	701008170H1	SOYMON019	g1850792	BLASTN	507	1e-48	83
3644	4533	701058588H1	SOYMON033	g1850792	BLASTN	493	1e-31	82
3645	4533	701130254H1	SOYMON037	g1850792	BLASTN	427	1e-55	84
3646	4533	701131239H1	SOYMON038	g1850792	BLASTN	455	1e-27	84
3647	4533	701135205H1	SOYMON038	g1850792	BLASTN	507	1e-33	84
3648	4533	701136840H1	SOYMON038	g1850792	BLASTN	385	1e-21	85
3649	4533	701141535H1	SOYMON038	g1850792	BLASTN	498	1e-32	83
3650	4533	701142624H1	SOYMON038	g1850792	BLASTN	455	1e-28	84
3651	4533	701143656H1	SOYMON038	g1850792	BLASTN	504	1e-64	83
3652	4533	701144723H1	SOYMON031	g1850792	BLASTN	407	1e-46	83
3653	4533	701146448H1	SOYMON031	g1850792	BLASTN	258	1e-10	83
3654	4533	701148343H1	SOYMON031	g1850792	BLASTN	507	1e-54	84
3655	4533	701148621H1	SOYMON031	g1850792	BLASTN	507	1e-57	84
3656	4533	LIB3028-007-Q1-B1-D7	LIB3028	g1850792	BLASTN	507	1e-31	84
3657	4533	LIB3050-002-Q1-E1-G12	LIB3050	g1850792	BLASTN	504	1e-84	82
3658	4546	700894637H1	SOYMON024	g1429228	BLASTN	124	1e-20	77
3659	4546	701036956H1	SOYMON029	g2826881	BLASTN	525	1e-35	83
3660	4546	701041532H1	SOYMON029	g2826882	BLASTN	174	1e-31	95
3661	4796	700652920H1	SOYMON003	g2104680	BLASTN	777	1e-62	76
3662	4796	700663404H1	SOYMON005	g2104680	BLASTN	262	1e-20	69
3663	4796	700807535H1	SOYMON016	g2104680	BLASTN	330	1e-33	67
3664	4796	700847547H1	SOYMON021	g2104680	BLASTN	498	1e-32	82
3665	4796	700851708H1	SOYMON023	g2104680	BLASTN	646	1e-45	83
3666	4796	700961790H1	SOYMON022	g2104680	BLASTN	297	1e-34	72
3667	4796	700970350H1	SOYMON005	g2104681	BLASTN	56	1e-19	75

3710	5605	LIB3053-011-Q1-N1-E7	LIB3053	g1763063	BLASTN	78	1e-35	85
3711	5605	LIB3053-010-Q1-N1-B1	LIB3053	g1763062	BLASTN	346	1e-30	81
3712	570	700846492H1	SOYMON021	g2062176	BLASTN	179	1e-26	86
3713	570	700894740H1	SOYMON024	g2062176	BLASTN	191	1e-28	86
3714	5922	700565484H1	SOYMON002	g1899058	BLASTN	144	1e-22	77
3715	5922	700868485H1	SOYMON016	g1899058	BLASTN	116	1e-18	83
3716	5922	700943237H1	SOYMON024	g1899058	BLASTN	155	1e-23	71
3717	5961	700763147H1	SOYMON015	g671868	BLASTN	110	1e-18	69
3718	5961	700909837H1	SOYMON022	g2244754	BLASTN	145	1e-21	75
3719	6220	700660806H1	SOYMON005	g662930	BLASTN	116	1e-25	60
3720	6220	700901135H1	SOYMON027	g662930	BLASTN	186	1e-27	73
3721	6557	701068369H1	SOYMON034	g1101770	BLASTN	326	1e-46	70
3722	697	701059577H1	SOYMON033	g1292897	BLASTN	431	1e-25	63
3723	7166	701135334H1	SOYMON038	g414117	BLASTN	81	1e-19	66
3724	7236	700658905H1	SOYMON004	g1922964	BLASTN	233	1e-58	83
3725	7292	700556612H1	SOYMON001	g662923	BLASTN	281	1e-29	80
3726	7292	700675424H1	SOYMON007	g662924	BLASTN	148	1e-24	85
3727	7586	700672319H1	SOYMON006	g1101770	BLASTN	250	1e-36	74
3728	7586	700672929H1	SOYMON006	g1732246	BLASTN	515	1e-34	71
3729	7586	LIB3052-001-Q1-B1-H7	LIB3052	g1101769	BLASTN	453	1e-43	74
3730	7592	700678729H1	SOYMON007	g458966	BLASTN	304	1e-43	62
3731	7592	700831110H1	SOYMON019	g458966	BLASTN	246	1e-35	56
3732	7804	700756020H1	SOYMON014	g2104680	BLASTN	273	1e-22	68
3733	7804	700970227H1	SOYMON005	g2104680	BLASTN	317	1e-15	59
3734	7804	700974028H1	SOYMON005	g2104680	BLASTN	266	1e-11	63
3735	7950	700729027H1	SOYMON009	g1945282	BLASTN	666	1e-46	77
3736	8078	700666305H1	SOYMON005	g2104680	BLASTN	859	1e-62	79
3737	8078	700791826H1	SOYMON011	g2104680	BLASTN	396	1e-45	75
3738	8078	700987478H1	SOYMON009	g2104680	BLASTN	778	1e-56	77
3739	8078	701056185H1	SOYMON032	g2104680	BLASTN	315	1e-15	62
3740	8078	701129761H1	SOYMON037	g2104680	BLASTN	646	1e-45	79
3741	82	700673133H1	SOYMON006	g1430847	BLASTN	921	1e-67	82
3742	82	700891441H1	SOYMON024	g1430847	BLASTN	788	1e-56	79
3743	82	700975491H1	SOYMON009	g1945281	BLASTN	139	1e-21	96
3744	82	700980383H1	SOYMON009	g1945281	BLASTN	133	1e-20	91
3745	82	701044378H1	SOYMON032	g1945281	BLASTN	115	1e-17	67
3746	82	701047753H1	SOYMON032	g1945281	BLASTN	197	1e-29	97
3747	82	701048272H1	SOYMON032	g1945281	BLASTN	147	1e-22	96
3748	82	701048288H1	SOYMON032	g1945281	BLASTN	147	1e-22	96
3749	82	LIB3051-002-Q1-E1-D7	LIB3051	g1945281	BLASTN	167	1e-46	80
3750	82	LIB3051-039-Q1-K1-G12	LIB3051	g928929	BLASTN	907	1e-66	81
3751	82	LIB3051-084-Q1-K1-A12	LIB3051	g928929	BLASTN	955	1e-70	81
3752	8242	700562978H1	SOYMON002	g1763062	BLASTN	1045	1e-83	100
3753	8242	700654577H1	SOYMON004	g1763062	BLASTN	466	1e-52	89
3754	8242	700683276H1	SOYMON008	g1763062	BLASTN	843	1e-74	96
3755	8242	700761189H1	SOYMON015	g1763062	BLASTN	474	1e-53	92
3756	8242	700790555H2	SOYMON011	g1763062	BLASTN	1090	1e-82	100
3757	8242	700793624H1	SOYMON017	g1763062	BLASTN	692	1e-93	97



3758	8242	700797306H1	SOYMON017	g1763062	BLASTN	964	1e-71	94
3759	8242	700831193H1	SOYMON019	g1763062	BLASTN	970	1e-78	100
3760	8242	700852349H1	SOYMON023	g1763062	BLASTN	478	1e-50	92
3761	8242	700864869H1	SOYMON016	g1763062	BLASTN	764	1e-68	98
3762	8242	700865296H1	SOYMON016	g1763062	BLASTN	1006	1e-103	98
3763	8242	700869542H1	SOYMON016	g1763062	BLASTN	1110	1e-83	100
3764	8242	700873873H1	SOYMON018	g1763062	BLASTN	464	1e-64	92
3765	8242	700992121H1	SOYMON011	g1763062	BLASTN	549	1e-74	96
3766	8242	701001463H1	SOYMON018	g1763062	BLASTN	686	1e-87	100
3767	8242	701009789H1	SOYMON019	g1763062	BLASTN	547	1e-70	97
3768	8242	701012778H1	SOYMON019	g1763062	BLASTN	460	1e-52	91
3769	8242	701042608H1	SOYMON029	g1763062	BLASTN	1190	1e-90	100
3770	8242	701048487H1	SOYMON032	g1763062	BLASTN	474	1e-53	92
3771	8242	701050227H1	SOYMON032	g1763062	BLASTN	1145	1e-86	100
3772	8242	701053639H1	SOYMON032	g1763062	BLASTN	371	1e-34	81
3773	8242	701123790H1	SOYMON037	g1763062	BLASTN	391	1e-74	92
3774	8242	LIB3054-010-Q1-N1-F2	LIB3054	g1763062	BLASTN	549	1e-96	90
3775	8242	LIB3056-014-Q1-N1-G11	LIB3056	g1763062	BLASTN	474	1e-71	89
3776	8242	LIB3056-003-Q1-N1-H1	LIB3056	g1763062	BLASTN	1260	1e-131	93
3777	8317	700561923H1	SOYMON002	g2642435	BLASTN	131	1e-20	74
3778	8317	700892106H1	SOYMON024	g2642435	BLASTN	164	1e-24	73
3779	8317	700899889H1	SOYMON027	g2642435	BLASTN	213	1e-31	77
3780	8317	701003333H1	SOYMON019	g2642435	BLASTN	241	1e-35	78
3781	8317	701005077H1	SOYMON019	g2642435	BLASTN	155	1e-27	70
3782	8317	701010881H1	SOYMON019	g2642435	BLASTN	67	1e-17	77
3783	8317	701039015H1	SOYMON029	g1263097	BLASTN	217	1e-31	76
3784	8382	700560421H1	SOYMON001	g1899058	BLASTN	171	1e-30	68
3785	8382	701006630H1	SOYMON019	g1899058	BLASTN	155	1e-23	70
3786	8382	701010436H1	SOYMON019	g1899058	BLASTN	166	1e-24	69
3787	8382	701014821H1	SOYMON019	g1899058	BLASTN	165	1e-27	68
3788	8418	700560620H1	SOYMON001	g2832616	BLASTN	113	1e-22	46
3789	8418	700874673H1	SOYMON018	g2832616	BLASTN	83	1e-20	49
3790	8536	700564124H1	SOYMON002	g1263094	BLASTN	481	1e-31	74
3791	8536	700565513H1	SOYMON002	g1263095	BLASTN	243	1e-39	83
3792	8536	700849213H1	SOYMON021	g1263094	BLASTN	480	1e-30	75
3793	8536	700876718H1	SOYMON018	g1263094	BLASTN	453	1e-27	73
3794	8536	700891266H1	SOYMON024	g1263095	BLASTN	152	1e-38	85
3795	8536	700976667H1	SOYMON009	g1263094	BLASTN	452	1e-27	76
3796	8536	701013001H1	SOYMON019	g1263094	BLASTN	551	1e-37	74
3797	8536	701124025H1	SOYMON037	g1263094	BLASTN	485	1e-30	74
3798	8536	701206455H1	SOYMON035	g2642435	BLASTN	262	1e-38	83
3799	8766	700685146H1	SOYMON008	g22379	BLASTN	427	1e-31	82
3800	8766	700895522H1	SOYMON027	g22379	BLASTN	387	1e-22	81
3801	8766	700977785H1	SOYMON009	g22379	BLASTN	387	1e-35	81
3802	8766	701009551H1	SOYMON019	g22379	BLASTN	474	1e-29	76
3803	8766	701009560H1	SOYMON019	g22379	BLASTN	392	1e-22	81
3804	8793	700904667H1	SOYMON022	g1841474	BLASTN	746	1e-53	83
3805	8793	700904677H1	SOYMON022	g1841474	BLASTN	848	1e-61	84
3806	8793	700955479H1	SOYMON022	g1841474	BLASTN	496	1e-64	83
3807	8793	700958582H1	SOYMON022	g1841474	BLASTN	729	1e-52	80
3808	8793	700961381H1	SOYMON022	g1841474	BLASTN	838	1e-61	85

3809	8793	700964029H1	SOYMON022	g1841474	BLASTN	881	1e-64	86
3810	8793	LIB3028-006-Q1-B1-A8	LIB3028	g1841474	BLASTN	1207	1e-92	84
3811	897	700686620H1	SOYMON008	g790635	BLASTN	144	1e-21	83
3812	897	700741338H1	SOYMON012	g790635	BLASTN	112	1e-17	74
3813	8985	700894021H1	SOYMON024	g171580	BLASTN	152	1e-25	47
3814	8985	700894303H1	SOYMON024	g171580	BLASTN	177	1e-26	49
3815	9000	700897913H1	SOYMON027	g1206002	BLASTN	736	1e-52	84
3816	9000	700899221H1	SOYMON027	g1206002	BLASTN	779	1e-56	84
3817	9000	700979179H1	SOYMON009	g1206002	BLASTN	452	1e-46	87
3818	9000	701150426H1	SOYMON031	g1206002	BLASTN	909	1e-67	87
3819	9000	701150655H1	SOYMON031	g1206002	BLASTN	495	1e-32	79
3820	9000	701154351H1	SOYMON031	g1206002	BLASTN	840	1e-61	84
3821	9000	701154756H1	SOYMON031	g1206002	BLASTN	786	1e-56	83
3822	9293	700754809H1	SOYMON014	g2062176	BLASTN	134	1e-20	92
3823	9293	700909018H1	SOYMON022	g2062176	BLASTN	134	1e-20	92
3824	9293	701106927H1	SOYMON036	g2062176	BLASTN	134	1e-20	92
3825	9293	701126505H1	SOYMON037	g2062176	BLASTN	104	1e-22	74
3826	9293	LIB3051-107-Q1-K1-C1	LIB3051	g2062176	BLASTN	105	1e-52	65
3827	9376	700831926H1	SOYMON019	g695690	BLASTN	126	1e-19	46
3828	9376	701213194H1	SOYMON035	g695690	BLASTN	122	1e-18	46
3829	9561	700665919H1	SOYMON005	g1046277	BLASTN	254	1e-22	79
3830	9561	700842724H1	SOYMON020	g1046277	BLASTN	254	1e-15	88
3831	9795	700952349H1	SOYMON022	g1841474	BLASTN	994	1e-82	91
3832	9795	700956022H1	SOYMON022	g1841474	BLASTN	887	1e-73	90
3833	9795	700958780H1	SOYMON022	g1841474	BLASTN	501	1e-65	87
3834	9795	700959106H1	SOYMON022	g1841474	BLASTN	928	1e-68	89
3835	9795	700960315H1	SOYMON022	g1841474	BLASTN	897	1e-73	90
3836	9795	700960664H1	SOYMON022	g1841474	BLASTN	678	1e-51	90
3837	9802	700953222H1	SOYMON022	g166591	BLASTN	116	1e-25	50
3838	9802	700959943H1	SOYMON022	g1206002	BLASTN	405	1e-23	70
3839	9802	701205476H1	SOYMON035	g166589	BLASTN	432	1e-25	77
3840	9916	700667883H1	SOYMON006	g290056	BLASTN	611	1e-42	72
3841	9916	700731014H1	SOYMON009	g290056	BLASTN	673	1e-47	74
3842	9916	700740852H1	SOYMON012	g290056	BLASTN	717	1e-50	73
3843	9916	701040044H1	SOYMON029	g290057	BLASTN	160	1e-27	81
3844	9916	701052544H1	SOYMON032	g290056	BLASTN	768	1e-55	80
3845	9916	701052934H1	SOYMON032	g290056	BLASTN	702	1e-49	72
3846	9916	701065663H1	SOYMON034	g172877	BLASTN	402	1e-51	77
3847	9916	701121723H1	SOYMON037	g290056	BLASTN	449	1e-35	69
3848	9916	701122023H1	SOYMON037	g290056	BLASTN	653	1e-45	72
3849	9916	701123218H1	SOYMON037	g290056	BLASTN	616	1e-42	72
3850	9916	701136006H1	SOYMON038	g290056	BLASTN	833	1e-60	79
3851	9916	701209561H1	SOYMON035	g290056	BLASTN	842	1e-61	78
3852	9916	LIB3049-054-Q1-E1-C8	LIB3049	g2982330	BLASTN	993	1e-74	78
3853	9916	LIB3052-012-Q1-N1-D8	LIB3052	g172877	BLASTN	721	1e-49	78

***Table Headings**

Cluster ID

A cluster ID is arbitrarily assigned to all of those clones which belong to the same cluster at a given stringency and a particular clone will belong to only one cluster at a given stringency. If a cluster contains only a single clone (a “singleton”), then the cluster ID number will be negative, with an absolute value equal to the clone ID number of its single member. The cluster ID entries in the table refer to the cluster with which the particular clone in each row is associated.

Clone ID

The clone ID number refers to the particular clone in the PhytoSeq database. Each clone ID entry in the table refers to the clone whose sequence is used for (1) the sequence comparison whose scores are presented and/or (2) assignment to the particular cluster which is presented. Note that a clone may be included in this table even if its sequence comparison scores fail to meet the minimum standards for similarity. In such a case, the clone is included due solely to its association with a particular cluster for which sequences of one or more other member clones possess the required level of similarity.

Library

The library ID refers to the particular cDNA library from which a given clone is obtained. Each cDNA library is associated with the particular tissue(s), line(s) and developmental stage(s) from which it is isolated.

NCBI gi

Each sequence in the GenBank public database is arbitrarily assigned a unique NCBI gi (National Center for Biotechnology Information GenBank Identifier) number. In this table, the

NCBI gi number which is associated (in the same row) with a given clone refers to the particular GenBank sequence which is used in the sequence comparison. This entry is omitted when a clone is included solely due to its association with a particular cluster.

Method

The entry in the “Method” column of the table refers to the type of BLAST search that is used for the sequence comparison. “CLUSTER” is entered when the sequence comparison scores for a given clone fail to meet the minimum values required for significant similarity. In such cases, the clone is listed in the table solely as a result of its association with a given cluster for which sequences of one or more other member clones possess the required level of similarity.

Score

Each entry in the “Score” column of the table refers to the BLAST score that is generated by sequence comparison of the designated clone with the designated GenBank sequence using the designated BLAST method. This entry is omitted when a clone is included solely due to its association with a particular cluster. If the program used to determine the hit is HMMSW then the score refers to HMMSW score.

P-Value

The entries in the P-Value column refer to the probability that such matches occur by chance.

%Ident

The entries in the “%Ident” column of the table refer to the percentage of identically matched nucleotides (or residues) that exist along the length of that portion of the sequences which is aligned by the BLAST comparison to generate the statistical scores presented. This entry is omitted when a clone is included solely due to its association with a particular cluster.